The Electrical Industry's Weekly Magazine

FEBRUARY 6, 1956

Electrical World

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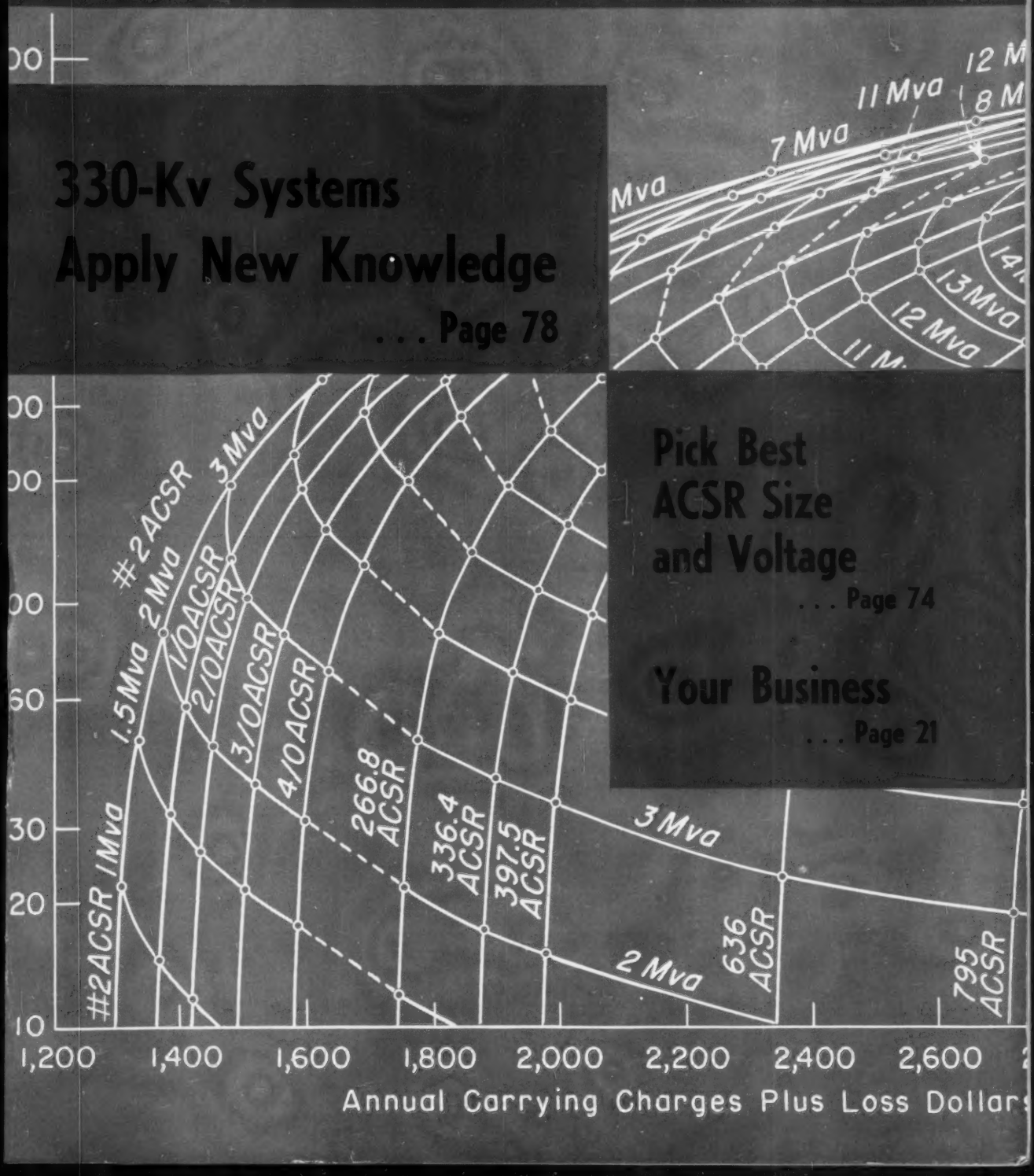

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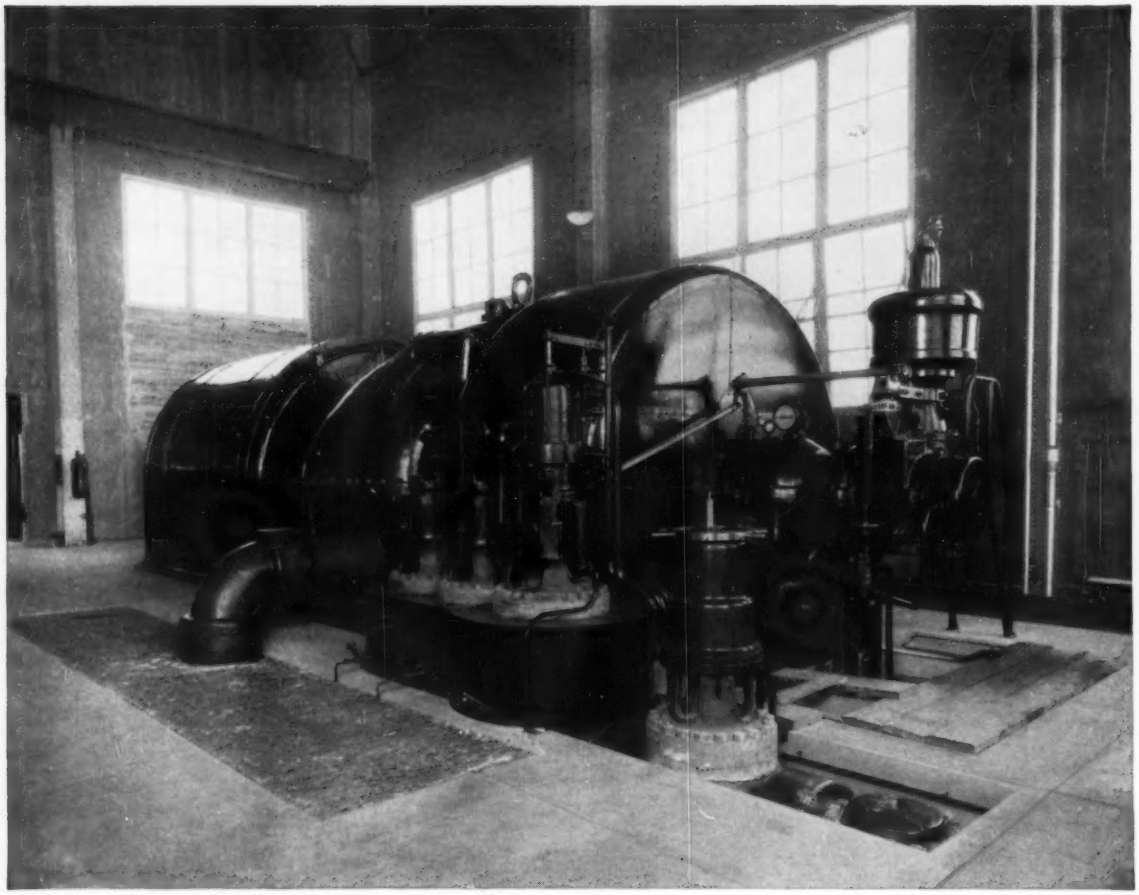

Texaco-lubricated for 26 years . . . still on original bearings

Miami Copper Company, Miami, Arizona, has every reason to be proud of this 15,000 kw. Westinghouse turbine. Its output, since it went on the line in 1929, is in excess of two billion kilowatt hours and original bearings are still in use.

Mr. W. H. James, Miami's Power Plant Superintendent, ascribes this to careful maintenance procedures and the fine protection given by *Texaco Regal Oil B* which has been the only lubricant used.

In 1935 the original fill of Regal Oil B was replaced by new oil as a routine measure; this oil has been in service since that time with no replacement except "for sweetening" with periodic make-up. The oil is in perfect condition today.

Texaco Regal Oil has been a world-famous turbine oil for decades. *Texaco Regal Oil R&O* is the same fine oil with the added advantages of effective rust, oxidation and foam inhibitors.

A Texaco Lubrication Engineer will gladly give you full information. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power.

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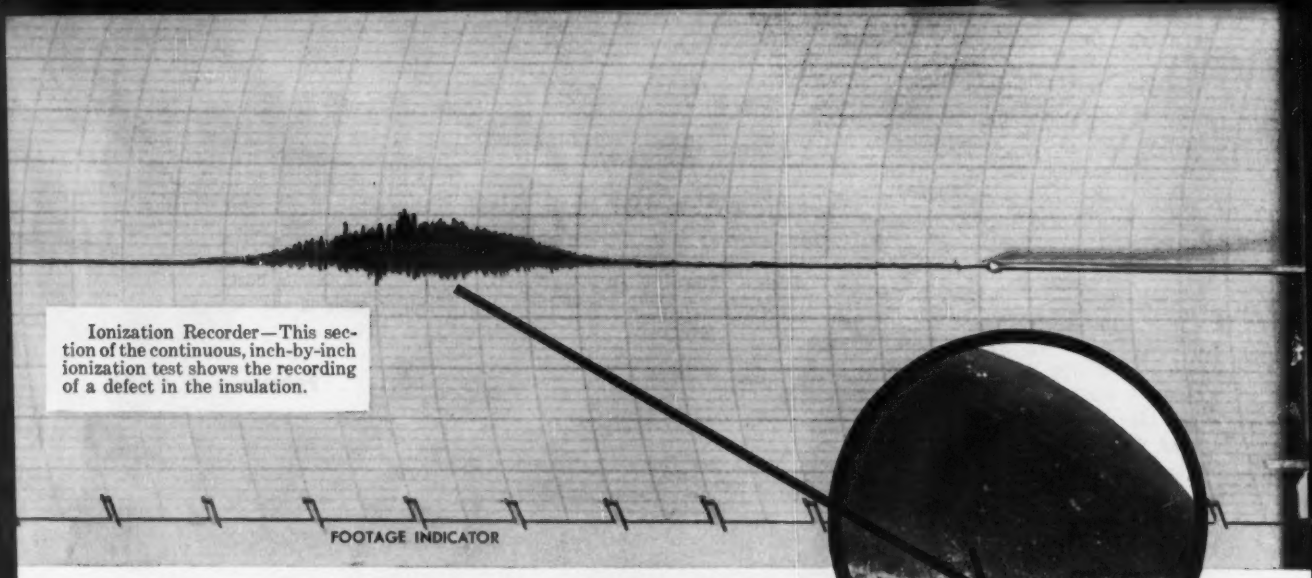


Ionization Recorder—This section of the continuous, inch-by-inch ionization test shows the recording of a defect in the insulation.

This void was detected by the "Gooding Test Train" ionization test. It was *not* detected by any of the industry's standard test procedures.

New Testing Procedure developed by Okonite

"Gooding Test Train" detects flaws in insulated power cable (4kv and over) heretofore unrevealed by standard tests

The "Gooding Test Train" has significant value to cable users. This new system of *non-destructive* testing, developed and used only by Okonite, reveals imperfections which are frequently not detected by ordinary testing procedures. Some of them even slip by Okonite's super-voltage a-c and d-c tests (highest used in the industry) and "full reel" corona tests.

The "Gooding Test Train" consists of a series of three test sets. The entire length of cable passes consecutively through each set as follows:

SCHEMATIC DRAWING OF GOODING TEST TRAIN

1. Uniformity Test—A uniformity gauge continuously checks insulation thickness—locating any thin spots which might cause premature failure.

2. Ionization Test—This is the most important unit of the "Gooding Test Train". It can measure the corona level at any spot along the cable. Procedure is to test the cable *inch-by-inch* at a predetermined voltage which is sufficient to assure the user that the corona level is at least 1½ times the rated voltage. Voids and imperfections as small as a grain of sand have thus been identified and removed.

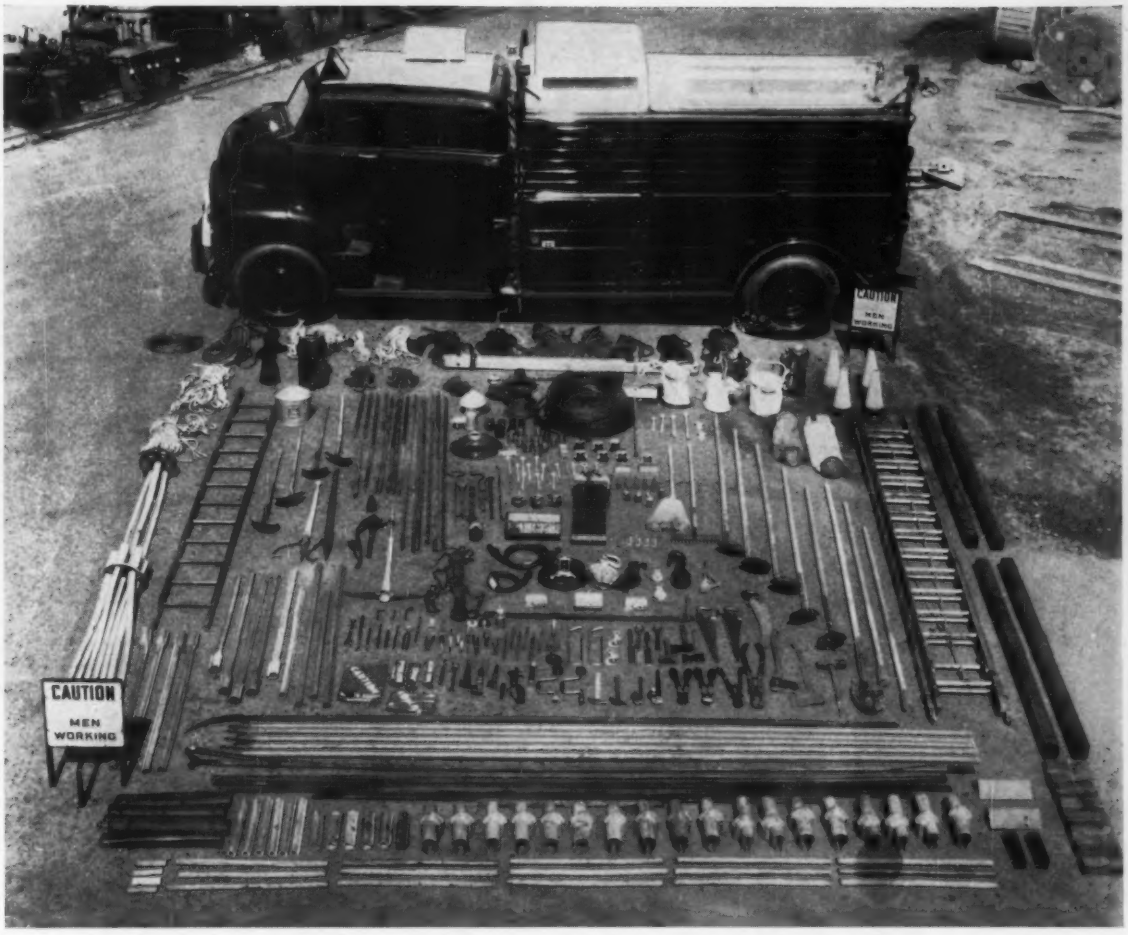
3. X-Ray Test—X-ray inspection of the cable is performed by a 250,000 volt X-ray machine. This determines the nature and extent of any of the flaws indicated above.

By such intensive testing, it is possible to eliminate previously unidentified imperfections that might otherwise lead to premature failure. Studies of such defects also help to identify the cause and permit preventive measures. The "Gooding Test Train" is now being used to test all Okonite's rubber-insulated cables rated at more than 4000 volts. It is a long step towards securing the "perfect cable" and, as such, of tremendous benefit to cable users.

For detailed information about Okonite's G.T.T. write for new Bulletin EW-1100, to The Okonite Company, Passaic, N. J.

3804

OKONITE — SINCE 1878 — *insulated cables*



Look at your line truck equipment needs from this angle . . .

Here's a poles-eye view of a typical utility line truck showing the wide variety of construction and maintenance tools and safety equipment your linesmen need for most day-to-day jobs. But—without exception—each and every item shown can be ordered conveniently from your nearby Graybar office or warehouse . . . and in every case you get the type and quality needed to assure speed and efficiency on the job *plus* long years of satisfactory service. All are products your linesmen know and respect—products that have been tried, tested and proven in the field by scores of companies just like your own.

Remember, when you order "via Graybar", you save the time and expense of multiple inquiries, for you can select, from this single source, the items best suited to your needs from among the products of over 200 of the nation's leading manufacturers.

Graybar is thoroughly familiar with utility requirements. Further, your nearby Graybar Representative stands ready to help as a convenient source of information on everything needed for pole-line construction and maintenance. And should you be faced with an out-of-the-ordinary problem, call on the experience of a Graybar Outside Construction Specialist for a consultation. We'll welcome your inquiry!

511-92

CALL GRAYBAR FIRST FOR . . .

Graybar Everything Electrical

GraybaR ELECTRIC CO., INC.
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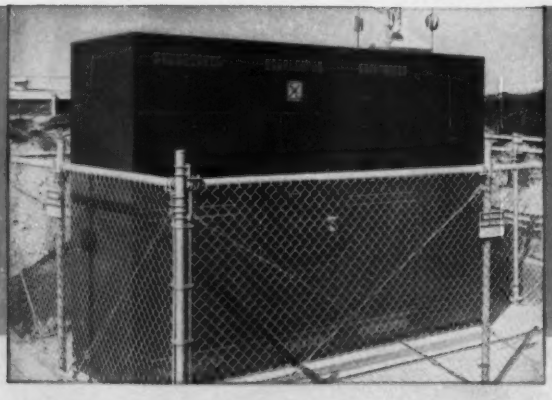
IN OVER 130 PRINCIPAL CITIES

Now... metalclad primary gear for ...in one Low Cost



SIMPLIFY PREFERRED-TO-EMERGENCY SWITCHING WITH

S & C's new "Package" approach

Here is a simplified solution to the demands for uninterrupted service . . . a complete throw-over "package" that overcomes the disadvantages of previous methods that were unsightly, costly, and complicated. S&C's new package is compact, economical, and completely enclosed—ideal for distribution and industrial substation applications.

LOW COST—Standardized design and factory assembly techniques provide substantial savings. The entire system is factory tested and ready to set into place . . . no costly on-the-site construction, assembly, or check-outs to make.

SAFE—The tamper-proof metalclad unit prevents access to unauthorized persons. Thus it is suitable for residential and industrial areas.

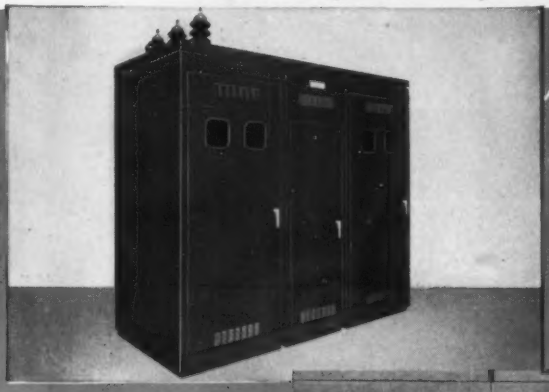
ATTRACTIVE APPEARANCE — All sensing, switching, and protective devices are enclosed in a metalclad unit. There are no ugly motor-driven, pole-mounted switches. Simple lines, neutral finish, and compact, streamlined construction are in keeping with the planning of today's residential and commercial neighborhoods.

15-CYCLE AUTOMATIC THROW-OVER—Throw-over in case of an outage is accomplished in about 15 cycles or less, rather than the several seconds required with motor mechanisms.

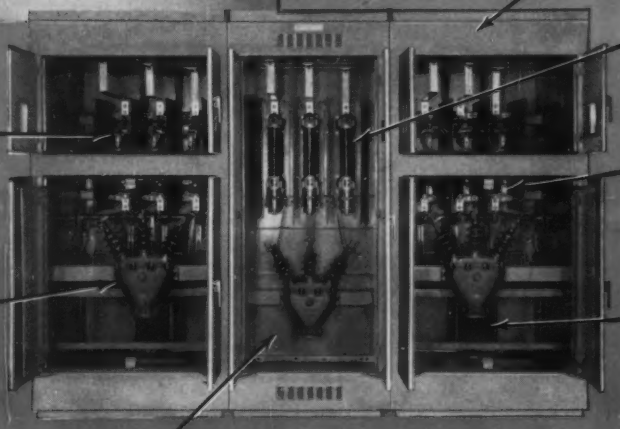
FULL LOAD INTERRUPTION—S&C Load Interrupter components permit the entire load to be dropped at any time under any conditions except short circuit.

throw-over schemes

Package



A TYPICAL S&C THROW-OVER PACKAGE



Super-Durable Finish is beautiful and long lasting . . . prevents rust and minimizes maintenance.

S&C Power Fuses protect transformer primary whether supplied by preferred or emergency source.

S&C Load Interrupter on preferred source opens on power failure.

S&C Load Interrupter on emergency source closes on power failure.

S&C Gear is a complete package ready for service. Just make up the potheads . . . no on-the-site engineering, assembly or testing required.

Potential Transformers sense both preferred and emergency sources . . . transfer occurs only if there is voltage on the alternate source. (Secondary sensing is optional.)

Control Panel and Operators (at rear of center section) provide for load transfer to an emergency source of power when there is a loss of voltage on the preferred source. With economical semi-automatic spring operators, the load is returned manually at the convenience of the operator. With optional hydraulic operators, back transfer occurs either when preferred voltage is restored or when a loss of voltage occurs on the alternate source.

S&C

Specialists in High-Voltage Switchgear for Electric Utilities since 1910

S&C ELECTRIC COMPANY

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NOW... greater piping loads, longer travels, with less headroom

The Grinnell Model R Constant-Support Pipe Hanger is available now in an *extended range* of sizes to provide completely overlapping coverage of loads from 47 lbs. to 32,267 lbs., and with travels up to 12 inches. New design modifications permit these hangers to be installed with a minimum of headroom, ranging from 29 inches (rod take-out) for the largest size — down to 10¾ inches for the smallest size.

The Model R provides constant support which is mathematically perfect for all positions of travel. This constancy of support is maintained throughout the full range of field adjustability. Needle bearings minimize friction.

Grinnell Constant-Supports are individually calibrated to support the exact load specified. All Model R Constant-Supports have a full 70 percentage points of field adjustability built into them. No less than 10% of this adjustability is allowed either side of calibration for plus or minus change in load. Field re-adjustments are easily made by turning a single load adjustment bolt.

Grinnell designs, manufactures, and distributes a complete line of pipe hangers and supports for every piping requirement. Grinnell maintains an experienced staff of engineers in the field — ready to assist you on the job with any piping problem.

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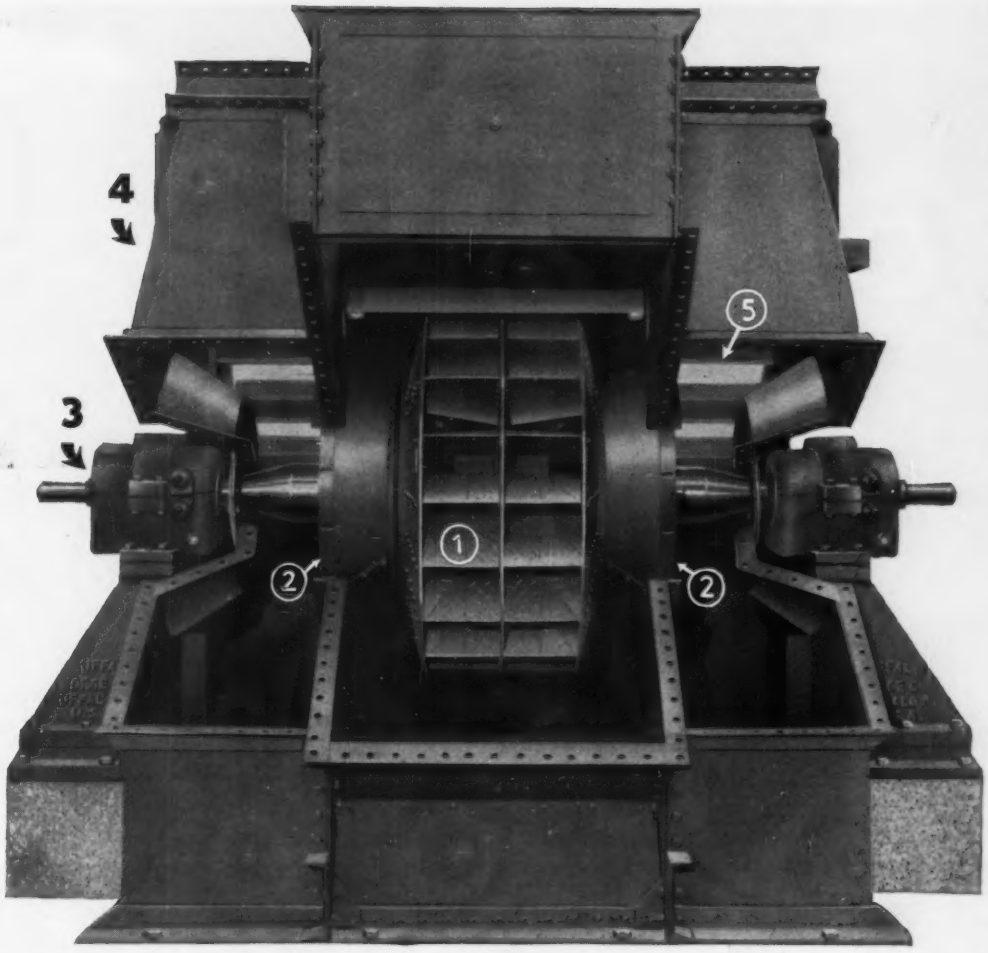


BUILT-IN INDUCED DRAFT ECONOMY!

1 "BUFFALO" ROTOR AND BLADES

are heavy plate, welded or hot-riveted for long-lasting strength. Backward-curved blades for best efficiency and least erosion at high operating capacity.

2 "BUFFALO" INLET VANES

for minimum turbulence and entry losses; standard with "Buffalo" Induced Draft Fans. Also available with variable inlet vanes.

3 "BUFFALO" BEARINGS

are self-aligning, reservoir-oiled and water or air cooled; shafts are over-size machined, stress-relieved forgings of high grade steel with solid thrust collars.

4 "BUFFALO" HOUSING

and inlet boxes are bolted sectional design with access doors for simplified cleaning and servicing. Heavy plate, resistant to erosion.

5 "BUFFALO" OUTLET DAMPERS

are available on F.D. or I.D. Fans. Provide parallel air-stream flow for reduced turbulence and smooth control.

•

WRITE FOR BULLETIN 3750

for further engineering data on these "Buffalo" Induced Draft Fans with long-run economy built into them.

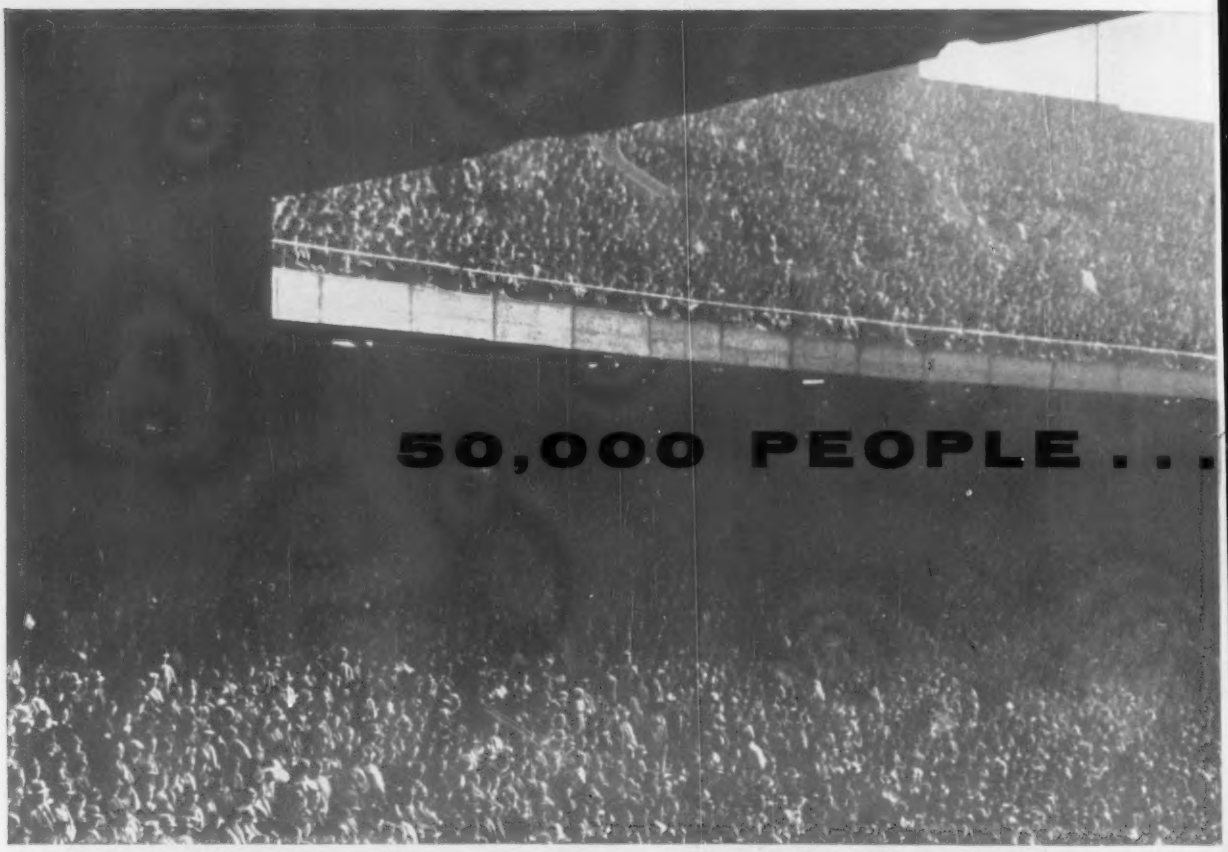
"Buffalo"

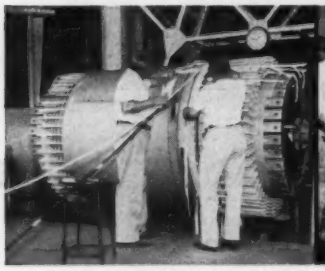
BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

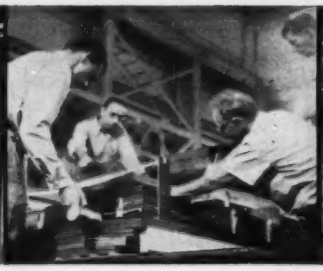
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING





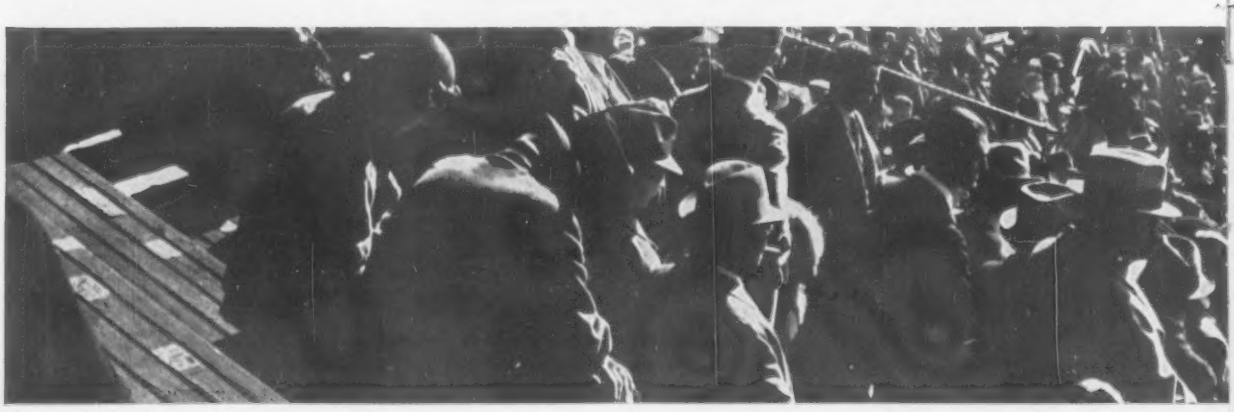
Coils are designed by experts and wound by craftsmen to provide windings that withstand surges and overloads of actual service.



Core steel is stacked carefully with sufficient oil ducts to eliminate hot spots.

Core laminations for upper header are installed after coils are mounted over core legs.

Moisture is removed from core-and-coil units by dehydration—without impairing insulation life.



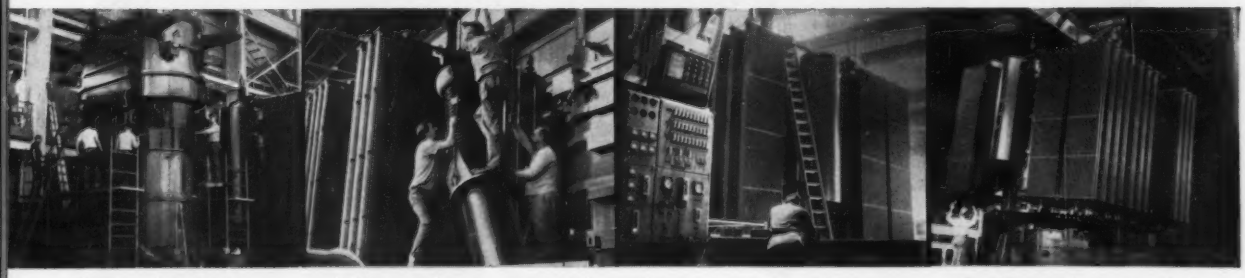
Ask them, any one of them, and they'll
all tell you the same thing. Stars don't win every game;
it takes real team work to do a winning
job . . . consistently.

. . CAN'T BE WRONG!

That's why Moloney emphasizes teamwork. Every step of
the way, from planning and designing to fabrication and testing,
Moloney's people work as a team. It's the best way to
produce dependable transformers that do a winning job . . .
consistently . . . for your utility system.

ME58-56

Specify Moloney . . . Get Dependability at its Best . . . All Along the Line



Core-and-coil units are quickly sealed in tanks, while still warm from dehydration process, to prevent absorption of moisture.

Bushings, radiators, gauges and accessories are installed before transformers are tested, assuring proper operation of transformers as complete units.

Tests to assure dependable performance and proper operation, according to your specified requirements, are made by competent transformer engineers.

Complete transformers, ready for delivery, are well designed, skillfully fabricated and thoroughly tested, assuring long life and dependable performance.

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For fewer outages... without sacrificing protection

Here are two well-liked and widely used KEARNEY *specialized* fuse links:

TYPE KS . . . specially developed to protect and yet keep outages to a minimum on circuits subject to switching and lightning surges . . . can carry overloads up to 150% indefinitely without damage to fuse link or cutout.

TYPE X . . . specially developed to keep transformers in service during overloads and surges . . . yet always interrupting current before the damage range of the transformer is reached. Opens 230% of rated load within five minutes.

ALSO . . . TYPE K—the EEI-NEMA standard fast fuse link . . . **and TYPE T**—the EEI-NEMA standard slow fuse link.

you need KEARNEY

SPECIALIZED FUSE LINKS

It stands to reason that average "fast" and "slow" fuse links cannot meet all the specific needs of your circuits. For safe operation with an absolute minimum of annoying outages, you need *specialized* KEARNEY fuse links. They're precision-engineered . . . with *matched* time-current characteristics . . . making possible easy and accurate coordination.

LINEMEN LIKE the time-saving, trouble-saving KEARNEY pull-tab Fuse-Pak . . . helps them select the right link quickly and accurately . . . even with gloves on. All KEARNEY Fuse-Paks are color-coded to save time and prevent mistakes.

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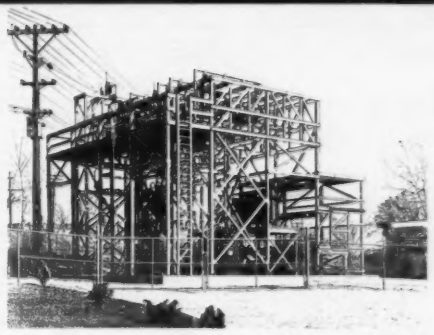
Canadian Plant: GUELPH, ONTARIO

FUSE LINKS FIELD TESTED . . .

Here at KEARNEY's 450,000 KVA Substation Laboratory all equipment is tested under rigorous field conditions, KEARNEY Certified Ratings are actual, proved performance ratings . . . not just theoretical calculations. You can be sure they will do the job they are supposed to do . . . with a generous margin of safety.



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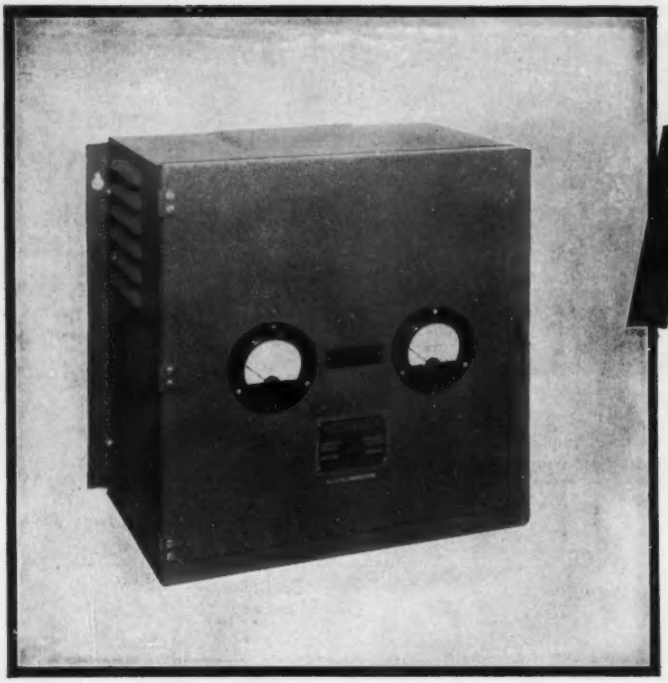
The Mark of Quality PRODUCTS



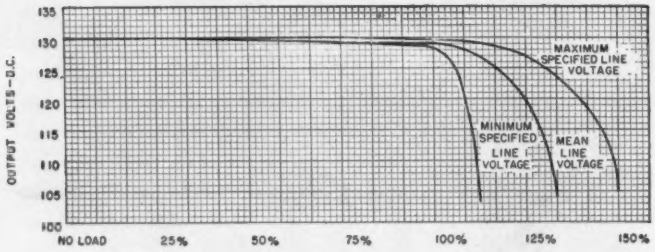
NEW!

Raytheon 60-Cell Battery Charger

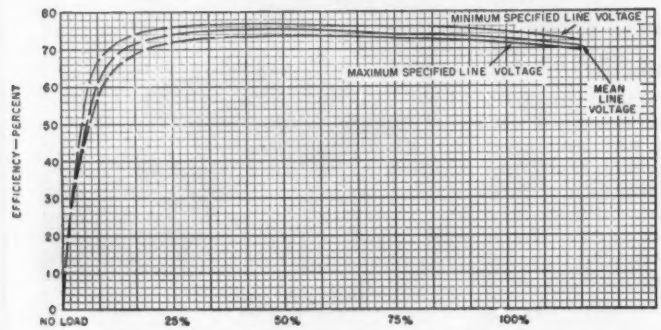
EXTENDS BATTERY LIFE
REDUCES BATTERY MAINTENANCE

IMPORTANT FEATURES

- **Constant potential charging—minimizes battery gassing**
- **Completely static operation—no moving parts**
- **Minimum maintenance—ideal for unattended sub-stations**
- **Rugged magnetic amplifier control circuit**
- **Self-protected—current limiting circuitry**



Regulation Curve (note automatic current limiting at overload to protect equipment)



Efficiency Curve (high efficiency at low loads reduces power consumption)

The new Raytheon 60-cell RectiChargeR® is a constant-potential battery charger specifically designed to maintain utility batteries at full standby potential and to provide maximum battery protection under all conditions. The RectiChargeR lengthens battery life and reduces maintenance, since gassing and water loss due to over or under charging are completely eliminated. Provision for applying periodic "freshening" charges insures uniformly high cell potential at all times.

The 60-cell RectiChargeR utilizes a rugged, magnetic amplifier control circuit which provides regulation to within ±1%. Long life and optimum performance result from completely static operation, self-protecting, current limiting circuitry, and automatic compensation for aging of the conservatively-rated selenium rectifiers.

Available in 3, 6, and 12 ampere models, the 60-cell RectiChargeR is the result of Raytheon's 25 years of experience in the battery charger field. For full information write for Product Data 4-310.

RAYTHEON MANUFACTURING COMPANY

Equipment Marketing Division, Waltham 54, Mass.

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Buried 15 Kv high-voltage cable

gets lasting protection with Du Pont ALATHON®

ALATHON® 4 for jacketing offers high impact strength, exceptional outdoor durability and superior resistance to stress cracking.
Shielding tape
ALATHON® 5 for primary insulation is unpigmented, has a low power factor and dielectric constant which remain essentially unchanged over the entire range of frequencies.

Cable supplied by Anaconda Wire & Cable Co., New York, N. Y.

A cable operating at 15 Kv underground must be constructed with insulation and jacketing which assure lasting, trouble-free protection. The insulation must have exceptional dielectric strength and the jacketing must have outstanding resistance to mechanical damage, chemical action and moisture. When a large eastern chemical company needed such a power cable for their new testing laboratory, they specified insulation and jacketing of "Alathon."

Du Pont "Alathon" polyethylene resin features low power loss and low dielectric constant, toughness and flexibility, even at extremely low temperatures, and outstanding moisture resistance. With insulation or jacketing of "Alathon," you get cable that is light in weight, flexible and easy to handle. Installation is speeded by its ease of pulling, cleanliness in handling, and simplified jointing and terminating requirements.

To get complete property and application data on "Alathon," clip and mail the coupon below.

There is a difference in polyethylenes-

specify ALATHON®

polyethylene resin

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 352, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for.....

.....

Name _____ *Position* _____

Firm Name _____

Street Address _____

City _____ *State* _____

Type of Business _____

This Seal

National Electrical Week—February 5-11

ALLIS-

Means - **New Economies for Bus Regulation**

25 REGULATING COMBINATIONS
This regulator equipped with
Vari-Amp Feature
ALLIS-CHALMERS

Here's how *Vari-Amp* feature lets you meet changing conditions

It's simple to match station regulator capacity to increasing loads with Allis-Chalmers exclusive *Vari-Amp* feature. Whenever greater current capacity is needed, it can be obtained by reducing the range of regulation. Then, the taps on the transformer supplying the regulator can be changed to obtain desired voltages.

Allis-Chalmers power regulators now have five current ratings in a single unit — 25 regulating combinations when you figure unequal ranges. A regulator is no longer the bottleneck to increasing substation capacity — now it can grow with your system.

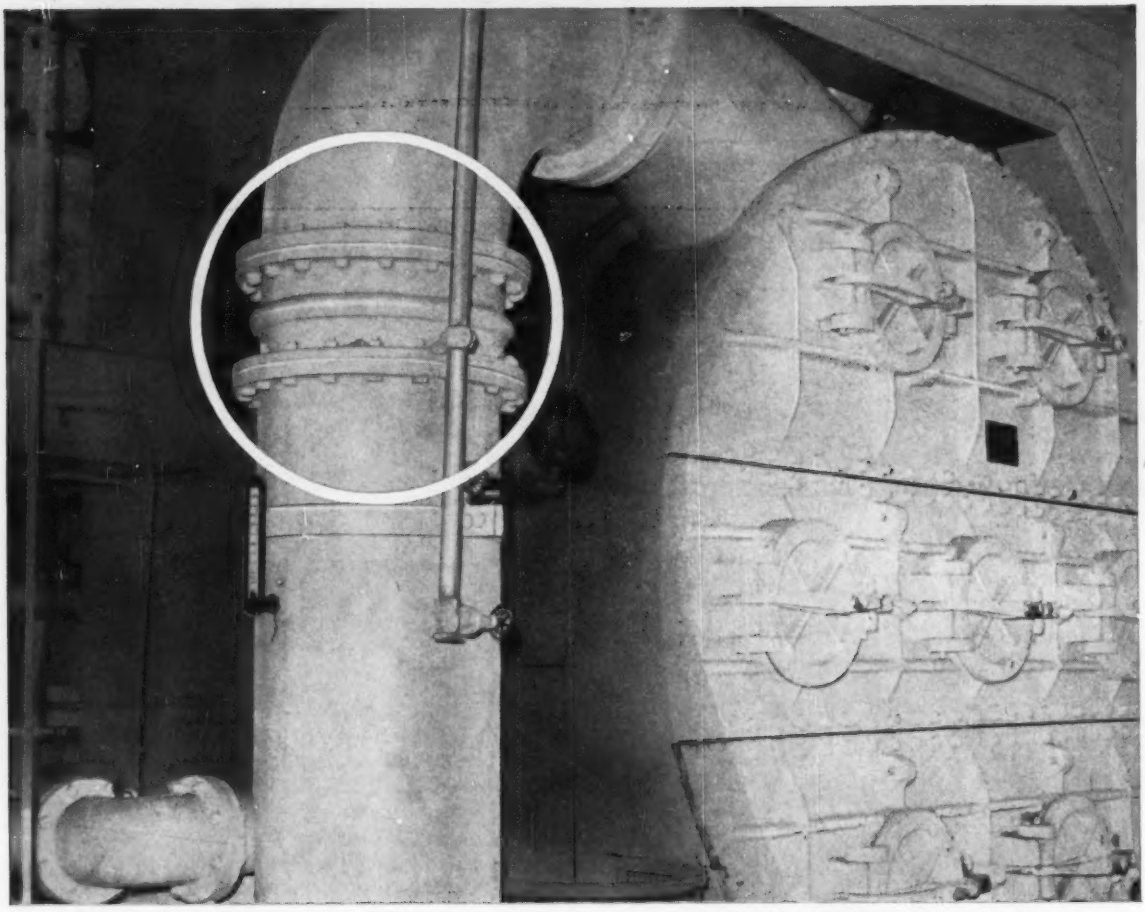
The example shown in the box below is only one of the many possibilities for improved regulation with the *Vari-Amp* feature. You get it on Allis-Chalmers voltage regulators. Get the full story. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4898

Here's One Example:

	Without Vari-Amp	With Vari-Amp
Transformer Voltage	100%	105%
Regulator Range	± 10%	5% to 10%
Bus Voltage	90% to 110%	95% to 110%
Rated Bus Current	100%	126%

ALLIS-CHALMERS
Originators of 5/8% Step Voltage Regulators

A-C CHALMERS
A-C ALLIS-CHALMERS



30-YEAR SERVICE RECORD CHALKED UP BY U. S. EXPANSION JOINTS IN WEST COAST POWER PLANT

Above is one of 12 U. S. Expansion Joints installed 30 years ago in a California utility plant. Despite their age these joints are still functioning.

U.S. Rubber Expansion Joints are economical, flexible connections used in pipe lines to take up the stresses due to vibration, expansion and contraction. They prevent the transmission of noise, and take care of misalignment. They have no moving parts to wear or bind and thereby shorten service life.

U.S. Rubber Expansion Joints can be installed on both new and old piping and equipment. These joints, plus engineering service, are available through any of our 27 "U. S." District Sales Offices, or write to us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

ELECTRICAL BUSINESS OUTLOOK

Electrical World
FEBRUARY 6, 1956

Electric revenues will advance to $7.5 billion this year—up 8.5% over 1955—according to Electrical World's latest estimates. This will not match the 9.6% gain of '55 over '54 due primarily to a leveling out of the Atomic Energy Commission take and smaller increase of only about 3% in industrial production predicted for 1956 over 1955. These revenue estimates apply to electric companies only.

Operating ratio will show further improvement slipping down from 44.4% last year to around 43.7% of the revenue dollar this year for power companies. That will be the best showing since 1945 when the operating ratio was 41.8%. Biggest factor in this expected improvement will be in the labor content of operating expense which dropped a full percentage point in 1955, from 19.4% to 18.4%. Fuel costs will take a slightly larger nick out of the revenue dollar primarily because of increases in coal prices.

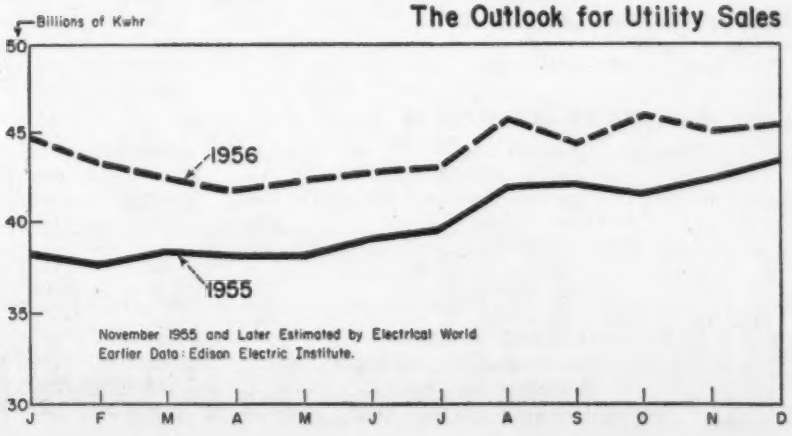
Residential customers will pay less per kwhr—an estimated average of 2.60¢ this year compared with 2.64¢ in 1955 for all suppliers. Average cost of increased use of energy was 2¢ per kwhr. Decrease reflects an estimated increase of 240 kwhr per residential customer over last year. This would bring average yearly use per customer up from 2,755 last year to 2,995 kwhr this year.

Utilities will pay more for coal. Wage increases granted miners last year began showing up under the escalation contract clauses last September. Another hike is due in April because of the second step in the wage grant. Higher prices for residual oil is strengthening the coal price structure.

Electrified farms gain despite drop in number of farms. That's the preliminary finding of the 1954 Census of Agriculture. From 1950 to 1954 the number of electrified farms rose from 4.2 million to 4.4 million while total number of farms fell from 5.4 million to 4.8 million.

Sales of electric sink and home laundry appliances in 1960 will be 35% above those of 1955. This forecast is behind General Electric Co's $10-million expansion program in this field. Bigger gainers will be washer-dryer combinations selling at eight times the 1955 rate, and waste disposers selling at twice the 1955 rate.

The Outlook for Utility Sales



Major Appliance Index Revised to Include Refrigerators

The National Electrical Manufacturers Association has combined the indices on unit sales billed of Electric Household Refrigerators and Major Electric Appliances (exclusive of household refrigerators). Both the old and the new indices are based on average month 1947-1949=100.

Separate sets of indices had originally been developed because of strong seasonal influence in household refrigerator sales prior to World War II. Since the war, this seasonal pattern has disappeared.

Major Electric Appliance Sales—Revised Index

Year	Average Index	1955	Index
1947	93	Jan.	108
1948	115	Feb.	107
1949	92	Mar.	117
1950	136	April	102
1951	102	May	108
1952	96	June	118
1953	94	July	98
1954	88	Aug.	101
		Sept.	114

Major Electric Appliance Index Components: Ranges over 2½ kw; storage water heaters; vacuum cleaners, standard size (includes floor and tank types); washers, standard size (includes automatic and non-automatic); ironers; farm and home freezers; and household refrigerators.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Nov.	113.55	112.13	101.11	12.3
Peak—Class I Systems (million kw)	Nov.	96.4	90.6	82.0	17.6
Estimated Dec. '55 Peak (million kw)	Nov.	97.44	96.72	96.07	1.4
Estimated Dec. '56 Peak (million kw)	Nov.	104.55	104.34	102.71	1.8
Production—billion kwhr	Nov.	47.76	47.37	40.21	18.8
Hydro		9.21	8.77	8.11	13.6
Fuel		38.54	38.60	32.10	20.1
Sales—billion kwhr	Nov.	43.07	43.16	36.29	18.3
Residential		10.71	10.33	9.72	10.2
Commercial		6.61	6.87	6.08	8.7
Industrial		23.37	23.45	18.26	28.0
Other		2.38	2.51	2.23	6.7
Fuel Consumption	Nov.				
Coal—million tons		13.29	12.70	10.70	24.2
Oil—million barrels		7.10	6.04	5.82	22.0
Gas—billion cu ft		82.26	104.75	88.40	−6.9
Net Income Class A & B Co's—$ million	Nov.	104.29	95.67	95.12	9.6
Residential Customers—millions	12 mos. ended Nov. 30	44.30	44.21	43.04	2.9
Revenue per kwhr		2.65¢	2.65¢	2.70¢	−1.9
Avg kwhr per customer		2,728	2,715	2,529	7.9
Avg annual bill		$72.29	$71.95	$68.28	5.9

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Dec.	141	146	128	10.2
ENR Construction Cost	Dec.	141.1	141.1	134.7	4.8
BLS Cost-of-living	Dec.	114.7	115.0	114.3	0.3
NEMA Sales	Nov.				
Insulation materials		155	156	124	25.0
Electric appliances		88	96	71	23.9
Wholesale prices	Dec.				
Motors and generators		127.2	127	121.8	4.4
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		145.9	145.9	135.3	7.8
GNP—annual rate—$ billion	3rd Qtr.	392.0	384.8	358.8	9.3

Your Business

There are few of us who at one time or another have not wanted to own stock. Mostly we've been scared off by notions of how much we have to lay on the line, the 1929 crash, and plain lack of knowledge of the stock market.

Today you are at least partly protected against a recurrence of 1929. It is easy to get information about stocks and the stock market, and you don't need large sums of money to invest. The way is open for all to have a greater share in this country's growing prosperity.

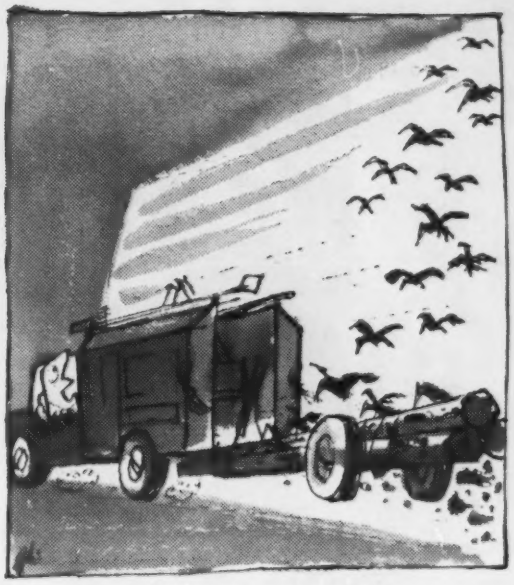
The New York Stock Exchange two years ago launched what is known as the Monthly Investment Plan (MIP). Now for anywhere from $40 to $1,000 a month, or quarter, you can start owning stock. MIP is simple and your broker can tell you all about it. You are under no obligation to send in your payments. You don't get penalized for quitting, but if you sell, there is a sales commission.

What stocks should you buy? For us in the electrical industry the initial choice is relatively easy. The electrical industry is certainly one of the most stable, dynamic and fastest growing industries in the country today. According to EW's Jan. 23 Statistical Issue, the power companies alone will spend close to $3 billion on expansion this year.

Another $1 billion will come from federal, municipal, and co-op expansion, making the total for all power expansion nearly $4 billion. Obviously this means a healthy slice of business for electrical manufacturers.

Consider electric utility common stock yields. On p 22 of this issue you will see that these stand at an average of 4.53% for first grade, 4.79% for second grade, and 5.14% for third grade common stock. Add to this the industry's inherent stability, and you have a pretty sound investment field. But remember this: MIP is not economical on a short-term basis. Plan to stay in it for several years.

Of course, you can also buy your favorite utility or electrical manufacturer share without joining any plan—and reap your share of the profits of an industry that will double its business in the next ten years.



"Woodpeckers at six o'clock."

Your Health

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

Primary cancer of the lung is often the cause of death. Much has been said about the relationship between excessive smoking and air pollution and lung cancer. Even what constitutes excessive smoking is nebulous.

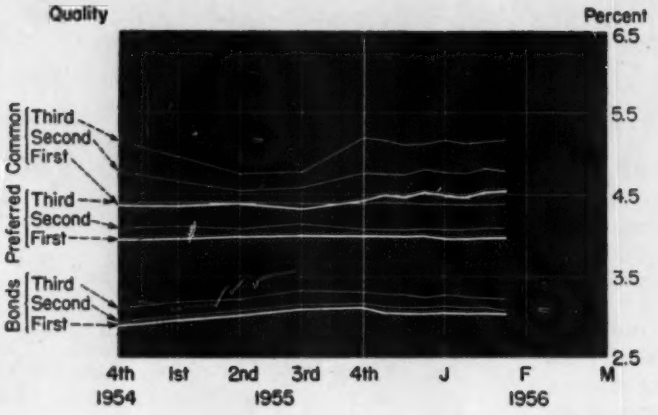
There are ample medical diagnostic facilities available if people would only use them. Often too much time elapses between onset of symptoms and recognition of the disease causing them. The only way to control cancer is to recognize and eradicate it early.

The more common symptoms which may indicate an early lung cancer are repeated chest colds, a persistent ache in the chest, difficulty in breathing, blood streaked sputum, and fever. Any of these should be reason enough to consult your physician.

X-rays of the chest will reveal most lung cancers. Direct examination of the lung with a bronchoscope will confirm the presence of some obstructive lesions. Examination of the sputum will reveal the presence of cancer cells in many cases. Surgical exploration of the lung and the removal of affected areas can be accomplished by the thoracic surgeon with a minimum of risk.

Men over 40 should submit to an annual complete examination. This is your best bet for controlling disease processes. Remember, cancer must be removed before it spreads or it will be fatal. Eternal vigilance over our bodies is the price of good health. Why settle for 50 years when you could have 100?

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Jan. 26.....	3.04	3.09	3.21	3.98	4.09	4.39	4.53	4.79	5.14
Jan. 19.....	3.06	3.12	3.23	3.99	4.09	4.38	4.52	4.81	5.12

Utility Earnings

COMPANY	PERIOD MONTHS	ENDED	NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Detroit Edison.....	12	Dec.*	$26,297,190	$22,137,173	$2.43(a)	$2.05(a)
Houston Lighting & Power.....	12	Dec.*	15,083,615	13,112,630	2.52(a)	2.30(a)
Minnesota Power & Light.....	12	Dec.*	4,112,951	3,551,138	2.06	1.73
Northern States Power (Minn.).	12	Dec.*	18,691,896	17,229,948	1.16(a)	1.07(a)
Ohio Edison, consolidated.....	12	Dec.*	23,350,814	20,270,680	3.55	3.02
Oklahoma Gas & Electric.....	12	Dec.*	8,367,255	6,974,674	2.34(b)	2.18(b)
Southern Co, consolidated.....	12	Dec.*	26,377,617	23,368,065	1.34(a)	1.29(a)

Notes—(a) Based on shares outstanding at end of period, and (b) Based on 2,984,783 shares in 1955 and 2,653,140 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
JANUARY 26—FEBRUARY 1			
COMMON STOCK			
Texas Utilities—400,000 sh	$14,100	$35.25	3.63%
Atlantic City Electric—75,000 sh	2,109	28.125	4.27
SCHEDULE FOR FEBRUARY			
BONDS			BID DATE
Central Power & Light—1st mtg due 1986.....	$10,000	.....	Feb. 14
Dallas Power & Light—1st mtg due 1986.....	10,000	.....	Feb. 15
Kansas Gas & Electric—1st mtg due 1986.....	7,000	.....	Feb. 27
Texas Electric Service—1st mtg due 1986	10,000	.....	Feb. 28
PREFERRED STOCK			
Southern California Edison—1,200,000 sh cum $25 per	$30,000	.....	Feb. 14*
Northern States Power—100,000 sh.....	10,000	.....	Feb. 29
COMMON STOCK			
Southern Indiana Gas & Electric—83,030 sh (to be offered commonholders on 1-for-11 basis, record Feb. 21 to expire Mar. 8, with no oversubscription privileges).....	.....	.....	.....
Kansas Gas & Electric—200,000 sh	.....	.....	Feb. 27

Notes—*Probable date of offering by First Boston Corp.—Dean Witter & Co, underwriters.

FINANCIAL BRIEFS

Wellington Fund has announced that it has equity investments in the electric utility industry aggregating more than $29 million, based on market prices at the year end. Largest common stock holdings were: 57,750 shares of Consumers Power Co; 52,200 shares of Pacific Gas & Electric Co; 60,000 shares of Texas Utilities Co; 60,000 shares of General Public Utilities Corp; 45,000 shares of Consolidated Edison Co of New York, and 40,000 shares of Southern California Edison Co.

Federal Power Commission has amended its rules to provide changes in power system statement forms that utilities are required to submit each year. Utilities, providing information on generating and transmission facilities, electric loads, etc, will benefit from simpler requirements for so-called "in load" systems that purchase all their power from other systems. Also the new rules provide that for the year 1955 full reports are to be made of certain system data rather than only the changes occurring during the year. Such full reports will be made every five years. FPC action came after one-months lapse of time since it proposed the new rules.

Massachusetts State Legislative Committee on Municipal Finance is studying a bill to allow municipal utilities to issue revenue instead of general obligation bonds.

Central Illinois Light Co is planning to make a common stock subscription offer of 100,000 shares to common stockholders of record April 3 on a 1-for-10 basis.

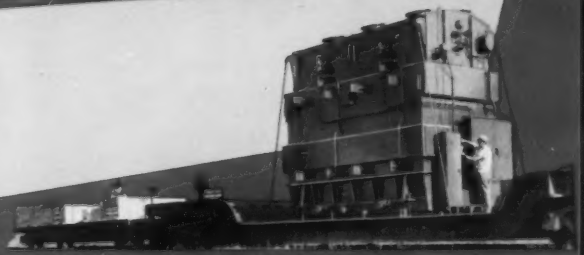
Higher Common Stock Dividends— Central Illinois Light Co will pay Mar. 23 a quarterly common stock dividend of 65¢ a share as compared with 55¢ a share in the previous quarterly . . . American & Foreign Power Co will pay Mar. 9 a quarterly common stock dividend of 20¢ a share versus 15¢ previously.

City Utility Tax Exempted—Roanoke, Va., City Council has voted an emergency ordinance exempting electric and gas used for space heating in private homes from the city's 7.5% utility bill tax.

140,000 Kva Pennsylvania Power Transformer

THREE PHASE CONTOUR DESIGN

140,000 Kva, 115 Kv, is the rating of this main step-up generating station transformer. Completely assembled except for bushings and coolers, it traveled by train to its destination in an upright position. This simplified the matter of installation and saved time and money for the utility. Pennsylvania's space-saving, shell form, Contour Design construction made this type of shipment and installation possible. Although it has a large Kva capacity, only 9000 gallons of oil are required to cool the transformer through four oil-to-air heat exchangers.



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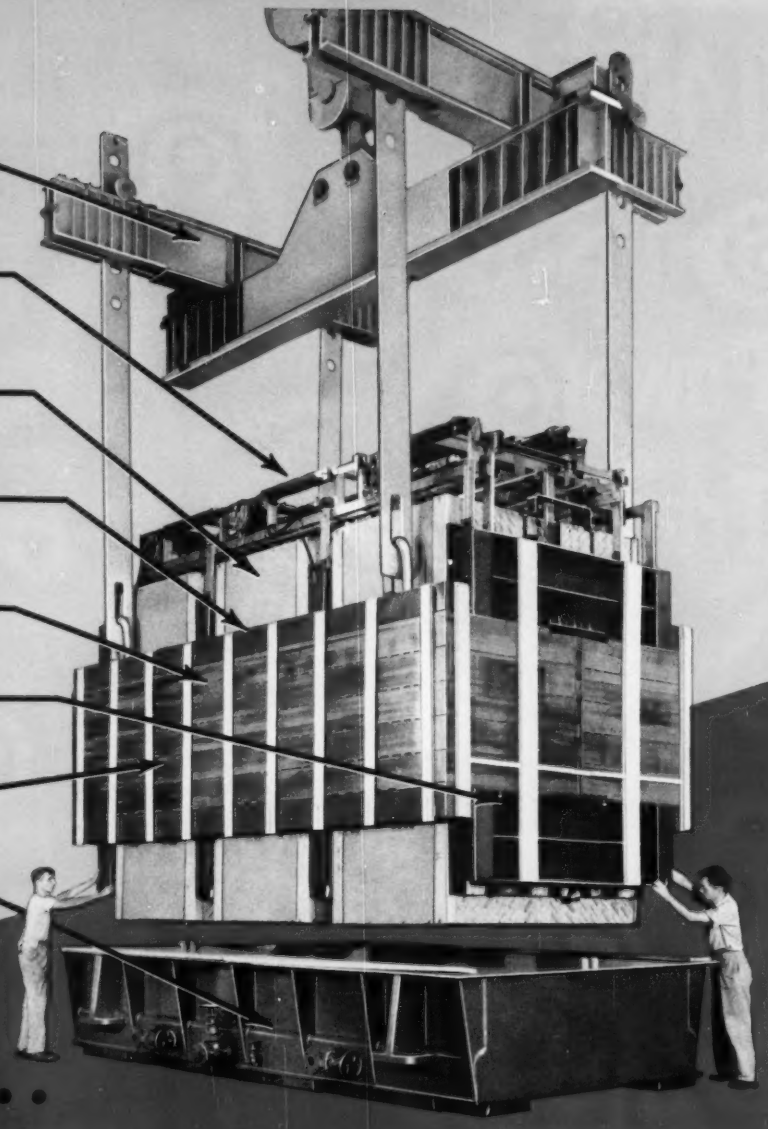
PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • ***Greater Pittsburgh District***

SEE NEXT PAGE FOR INSIDE STORY



Core and coil assembly being lowered into bottom tank section by Pennsylvania's 165-ton crane.

Straight line tap changer with silver alloy contacts is located above the core and coils where it is accessible through manholes for inspection and maintenance.

Vertical cooling ducts in the coils permit a free flow of oil through the coils for most efficient cooling.

Core and coils clamped together with heavy steel frames to form a rigid structure.

Core and coil unit can be handled separately as a complete sub-assembly.

Heavy box sections form part of core frame and clamp coils against mechanical forces during short circuits.

Core cooled by both vertical and horizontal ducts.

Core and coil assembly rests on bottom section of Contour Design tank.

Inside a . . .

140,000 Kva THREE PHASE CONTOUR DESIGN

Pennsylvania Power Transformer

140,000 Kva, Three Phase, 60 Cycles, 55° C. Temperature Rise.
High voltage: 115,000 Grd.Y/66,400 volts. Low voltage: 14,700Δ volts.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • ***Greater Pittsburgh District***

For exterior view of this transformer, see other side.

How a new coating...ALUDUR®... provides the answer to the corrosion problem in pole-line hardware

By James H. Foote, Vice President and Chief Engineer, Electrical Manufacturing Company

Technological advances during the past two or three decades have greatly increased the service life of most line construction materials. Unfortunately no similar substantial improvement in pole-line hardware has occurred. As a result hardware is now the limiting factor in the life of most lines. To make matters even worse, diversification of industry is introducing corrosion problems into many areas previously free of them.

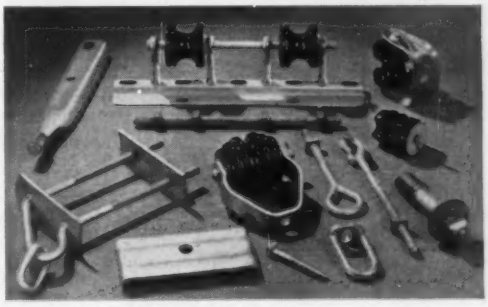
Over four years ago, here at Electrical Manufacturing Company, we began a search for a protective coating superior to zinc. Our studies resulted in the selection of aluminum for the coating material. A major factor in this decision was that ASTM outdoor corrosion tests* of over 20 years' duration indicated a marked superiority of aluminum, hot-dipped applied, over hot-dip galvanized steel. Extensive research led to the selection of a corrosion resistant alloy of aluminum that would properly alloy itself with steel to form the same strong, flexible bond obtained in good galvanizing. This bond is of the inter-metallic type similar to the iron-zinc bond of the hot-dip galvanizing process. The outer layer of aluminum has a thickness in the order of .003".

Here is an early pilot-scale Aludur line, showing the cleaning and pickling operation.

We have perfected a process by which the aluminum is applied and have named the resultant coating Aludur. Considerable research is still to be done, however, before full scale production can be realized. The much higher temperatures and the greatly reduced density of the molten aluminum have indicated the necessity of entirely different operating techniques than those used in galvanizing. A large portion of these techniques have been developed and our pilot plant is presently turning out a variety of products. Additional items will be available as more operating experience is gained.

Accelerated corrosion tests indicate that Aludur hardware will have a service life of at least three times that of the best hot-galvanized hardware. Outdoor long-time exposure tests are presently in progress in highly corrosive areas.

We are now in a position to produce limited quantities of many pole-line hardware items in Aludur. We feel that Aludur could solve many of your corrosion problems and of course invite your inquiries.



E-M products include bolts, anchor rods, braces, pins, pole-top fixtures, brackets, clevises, secondary racks—a complete line of pole-line hardware.

58

**Tests under the jurisdiction of Subcommittee XVI of ASTM Committee A-5 on Corrosion of Iron and Steel*

EM ELECTRICAL MANUFACTURING COMPANY • Battle Creek, Michigan

Designers and manufacturers of pole-line hardware that saves you time, money, and maintenance. Prompt action on special problems.

NEW!

T&B complete COLOR CODED splicing package speeds line and service work

Now one new UT 5 installing tool is the *only* tool you need to make all line and service compression connections . . . including splicers, taps, and pin terminals. And T & B's color-coding insures accurate, speedy connections on a wide range of copper, aluminum and A. C. S. R. cable. Here's all you do . . . match the color of the die to the color of the connector . . . compress . . . and the joint is made.

Your T & B Distributor will be glad to demonstrate the UT 5 with its many advantages. When you use this one tool you simplify all your line and service work. For further information write for new T & B bulletin.

LOOK FOR THIS SIGN — T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-61

THE THOMAS & BETTS CO.

INCORPORATED

14 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

New FW Homogeneous Reactor

for LOW-COST ATOMIC POWER

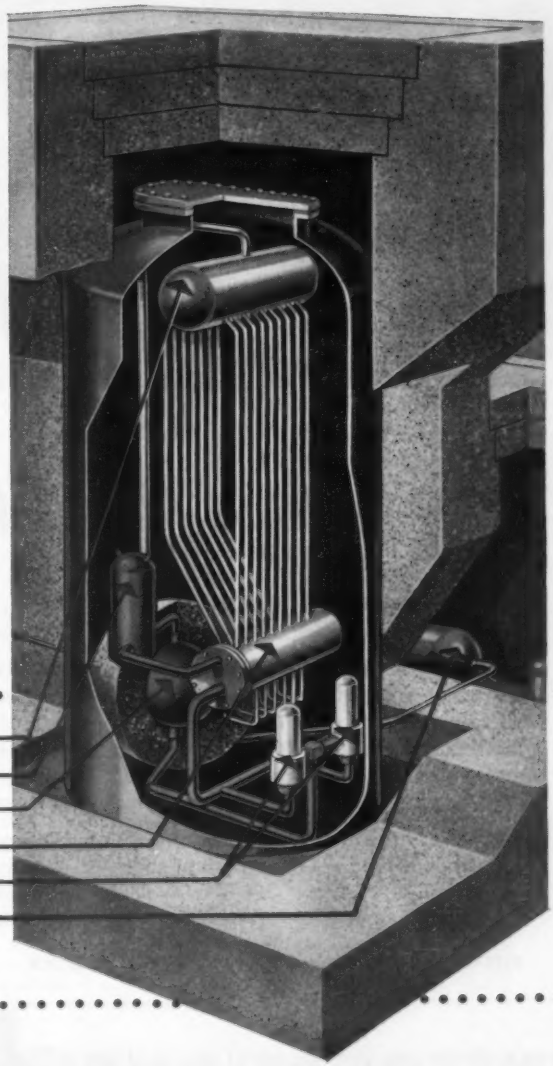
in the 5,000 to 40,000 kw output range

Simplicity of design, exceptional stability and ease of control are outstanding features of this small homogeneous power plant

The one-region aqueous homogeneous reactor illustrated in the cut-away drawing at the right has been designed by Foster Wheeler for economical production of electric power in the 5,000 to 40,000 kw range. It offers these unique advantages.

1. Reactor design is based on optimum nuclear parameters rather than heat removal.
2. Continuous chemical purification of the liquid reactor fuel removes fission and corrosion products.
3. No control or safety rods are necessary. Large negative temperature coefficient of reactivity enables reactor power to follow load demands rapidly and faithfully.
4. Reactor vessel is a simple, spherical pressure vessel.

Liquid fuel is pumped from the reactor to a heat exchanger and the steam thus generated can be superheated and used to drive a conventional turbo-generator. For more complete information, send for a copy of the November issue of Heat Engineering. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*



(HOT portions of circuit shown in red)

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

To save the BIG money in utility servicing..

Get the trucks that are All-Truck Built!

When you put INTERNATIONAL trucks on your job, you start making BIG savings in the area of biggest truck costs — operation and maintenance.

INTERNATIONALS work with less strain under load because they are *all-truck built*—with no passenger car design or engineering compromises, no passenger car engines or components asked to do a truck job. They move their loads at slower engine rpm — go extra miles per gallon of gas and quart of oil — go *more* miles over the years, with fewer overhauls and major servicing, less downtime for breakage and wear.

The proof is in the records of cost-conscious operators who have made INTERNATIONAL heavy-duty, 6-wheel and multi-stop trucks the sales leaders for years. See your INTERNATIONAL Dealer or Branch and get full facts on the right trucks for your job—all-truck built to save you the BIG money.

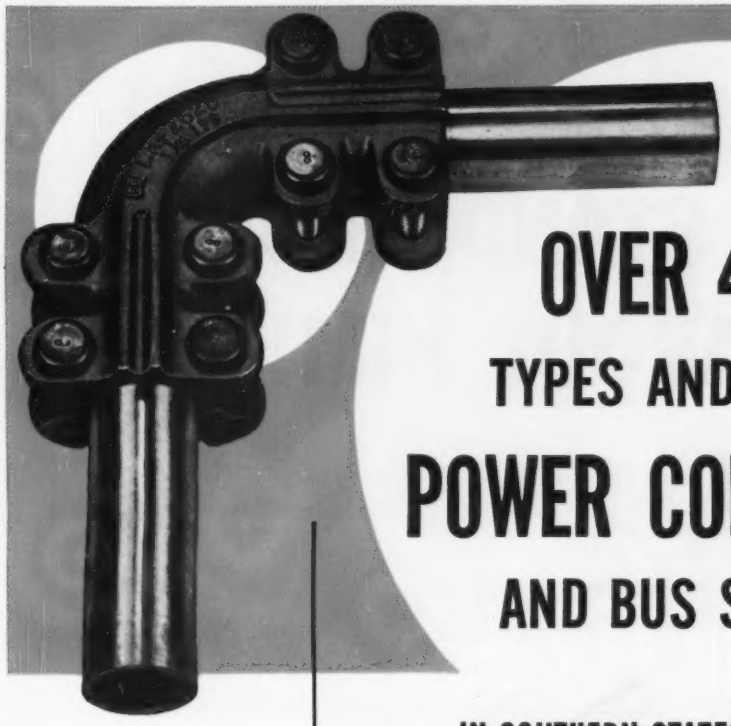
All-truck INTERNATIONALS for electrical and telephone servicing include 8 light-duty models with Service-Utility body (illustrated), plus 3 light and medium-duty four-wheel-drive models, conventional and cab-forward trucks in capacities for every service job. Widest truck choice in the world's most complete truck line.

INTERNATIONAL HARVESTER COMPANY · CHICAGO

INTERNATIONAL® TRUCKS

All-Truck Built to save you the BIG money!

Motor Trucks • Crawler Tractors • Industrial Power
McCormick® Farm Equipment and Farmall® Tractors



OVER 4,000
TYPES AND SIZES OF
POWER CONNECTORS
AND BUS SUPPORTS

IN SOUTHERN STATES' COMPLETE LINE

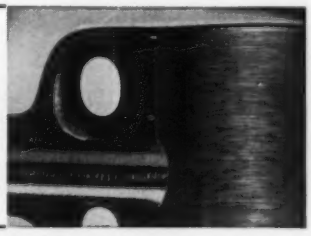
To meet the widest range of requirements for power and grounding connectors, Southern States produces more than 4,000 different types and sizes—many on special order to customers' specifications.

Widespread use of self-supporting, rigid, tubular bus constructions in substations has increased the mechanical requirements of many connectors. That is why Southern States connectors have been re-designed during the past two years. They now have stronger ears and are 40 to 50% heavier.

When you specify and use Southern States connectors, you can be sure they are capable of: 1) serving as self-supporting members; 2) providing good electrical connection; 3) developing full strength of clamping bolts without visible distortion; 4) carrying current equal to the conductor without excessive temperature rise; 5) being installed with a minimum of effort and time.

Rough Ground for Best Possible Contact

Every Southern States connector is rough ground on all contact surfaces. This permits the connector to bite into the conductor, causing intimate metal to metal engagement at thousands of high-pressure contact points, thus providing a better junction and one that is sealed against corroding atmosphere.



SS®

SOUTHERN STATES EQUIPMENT CORP.

HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

HE CAN'T STAND PEOPLE TALKING ABOUT HIM!

That's why Kennecott is telling the world about SKIMPY WIRING!

Left to his own devices, this obnoxious Skimpy Wiring character can wreak no end of havoc on the electrical business. His small, weak wires and inadequate circuits mean a dead end for power sales in more than 80% of the homes in your territory!

Fortunately, Skimpy Wiring is vulnerable. He simply cannot stand the limelight! Once folks recognize him, and realize that he is the cause of most of their electrical troubles, Skimpy Wiring is well on his way out!

That's why Kennecott is running ads like the one shown below — to put the finger on Skimpy Wiring and to show homeowners how to get rid of him! Designed to aid the entire electrical industry, this Kennecott campaign can add new life to your own local adequate wiring promotions, can boost the sale of power right in your own area!

FREE! PROMOTIONAL MATERIAL!

Send today for reprints and poster-sized blow-ups of Kennecott's full-page Saturday Evening Post and This Week Magazine ads. Ask for "The ABC of Home Wiring"— Kennecott's educational, 16-page booklet. Get the free Kennecott Home Wiring Wall Chart, mat service folder and list of *at-cost* prices for quantity orders of all available material. Write Kennecott Copper Corporation, Dept. W26, 161 E. 42nd St., New York 17, N. Y.

Kennecott Copper Corporation

Fabricating Subsidiaries: CHASE BRASS & COPPER CO. • KENNECOTT WIRE & CABLE CO.

SKIMPY WIRING
"Dead End" Kid of the
Electrical Business!

Allis-Chalmers...for Progress

The World's Largest

Hydraulically Operated Circuit Breaker

THIS Allis-Chalmers circuit breaker is now installed on a Western power system. It is rated 230 kv, 10,000,000-kva interrupting capacity.

The *Pneu-Draulic* operator used on this breaker is of the same basic design as those used on operators for Allis-Chalmers breakers from 13.8 kv up, and 500,000-kva to 10,000,000-kva interrupting.

With the *Pneu-Draulic* operator even this enormous circuit breaker can be closed at full-rated speed under emergency conditions without use of control power. One man using one hand can easily pump up sufficient pressure in less than a minute for full-speed closing.

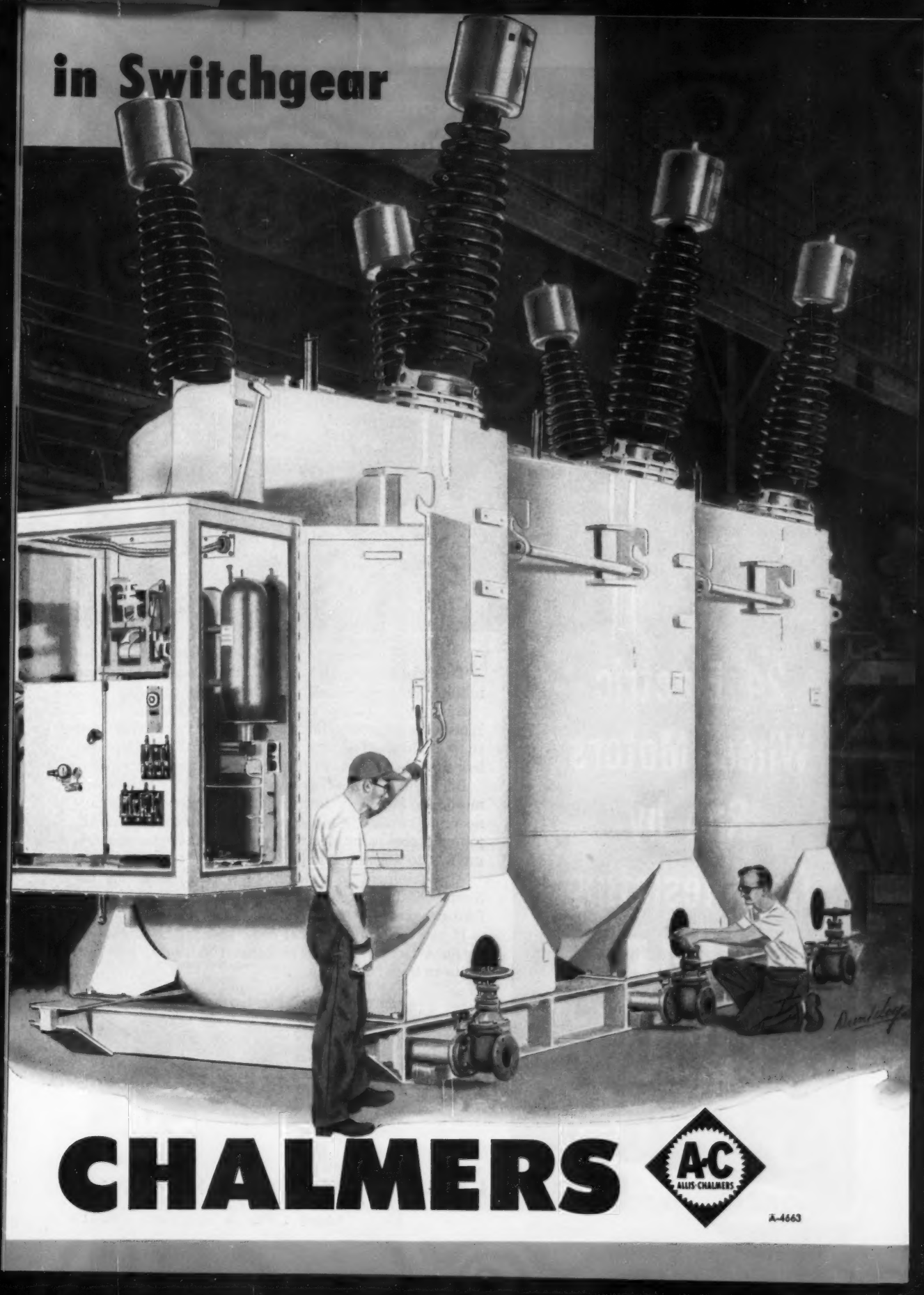
And it is perfectly safe to do this only because the operating mechanism is *mechanically trip-free.* Allis-Chalmers alone builds *all* breakers mechanically trip-free.

GET COMPLETE INFORMATION: Call your nearby A-C office or write Allis-Chalmers, General Machinery Division, Milwaukee 1, Wisconsin.

Pneu-Draulic is an Allis-Chalmers trademark.

National Electrical Week — February 5-11

ALLIS-


in Switchgear
CHALMERS
A-C
ALLIS-CHALMERS
A-4663

270-Foot Sno-Freighter Ferries 150-Ton Cargoes Overland in Arctic Winter

24 Electric Wheel Motors Run by Cold-Resisting SIMPLEX CABLES

This giant six-section cargo carrier supplies isolated military radar stations along the Arctic Coast.

Built by R. G. LeTourneau, Inc. for Alaska Freight Lines, the Sno-Freighter travels over ice, compacted snow, bulldozed trails and rough terrain. It runs on tubeless tires that are seven feet high and three feet wide.

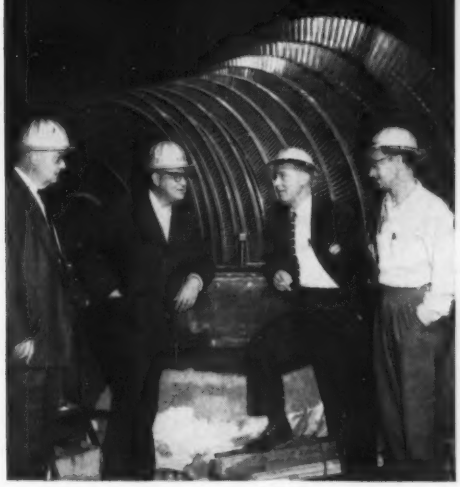
Each wheel is a package power unit with a DC electric motor and gear reduction unit built into the rim. Flexible neoprene-covered Simplex Cables designed for −50°F. temperatures carry electrical power from engine generating sets to the wheel motors.

All equipment to a height of six feet, including the Simplex Cables, are waterproof so the Sno-Freighter can ford streams.

If you have an electrical cable problem that involves extreme temperature or moisture conditions, why not write to the address below.

Simplex

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.



Robert Higgins, Howard Barr, John Dunnewind and H. I. "Hi" Lamphier (left to right) discuss lubrication of equipment at Clifty Creek plant. Howard Barr and Hi Lamphier are plant manager and assistant plant manager respectively. Standard Oil men Bob Higgins, industrial lubrication specialist and John Dunnewind, chief lubrication engineer provide lubrication technical service to customers. Together they have more than 38 years experience in such work—Bob 18 years, John 20. John has an engineering degree from the University of Michigan and is a graduate of Standard's Sales Engineering School. Customers of Bob Higgins and John Dunnewind find this kind of experience and training pay off *for them.*

Clifty Creek management selects NONPAREIL Turbine Oil—

—receives life-of-turbine guarantee for the oil

Approximately 60,000 gallons of NONPAREIL Turbine Oil were purchased for Clifty Creek, most of which are to be used to fill lubrication systems. Kilowatt capacity of installation will slightly exceed that of Hoover Dam.

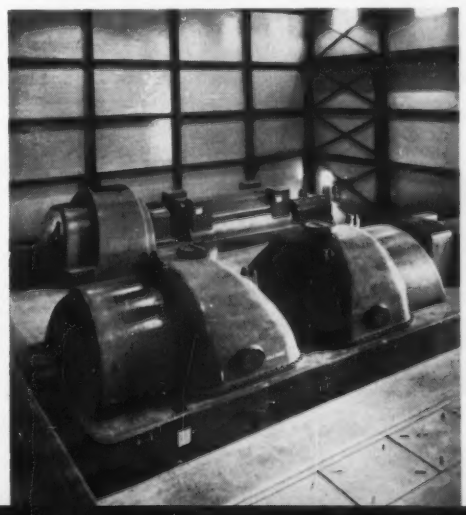
Power and lots of it has been ordered for the AEC gaseous diffusion plant near Portsmouth, Ohio. Clifty Creek Plant in Indiana is the larger of two plants being built by Ohio Valley Electric Corporation to supply this demand. Six giant turbo-generators will be housed in the Clifty Creek plant. Combined capacity will be 1,290,000 kw.

NONPAREIL Turbine Oil will be the lubricant for Clifty Creek's six 215,000 kw. turbines. The oil is guaranteed, for the life of the turbines, not to exceed a neutralization number of 0.15 mg.KOH/gm.

Six other important benefits are obtained by the use of NONPAREIL Turbine Oil:

1. Correct viscosity to lubricate without excessive fluid friction.
2. Good demulsibility to permit removal of water which unavoidably gets into the oil.
3. High oil stability to insure resistance to oxidation and sludging.
4. Low pour point for fluidity at any operating temperature normally met.
5. Resistance to foaming, with special additive to counteract foaming tendency.
6. Capacity for protecting metal parts against corrosion.

Clifty Creek turbines join more than 800 other turbines now using NONPAREIL Turbine Oil, some for as long as 29 years. Inquire about NONPAREIL Turbine Oil of your Standard Oil industrial lubrication specialist in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.



NONPAREIL Turbine Oil guarantee that will hang beside each of the six turbines at Clifty Creek.

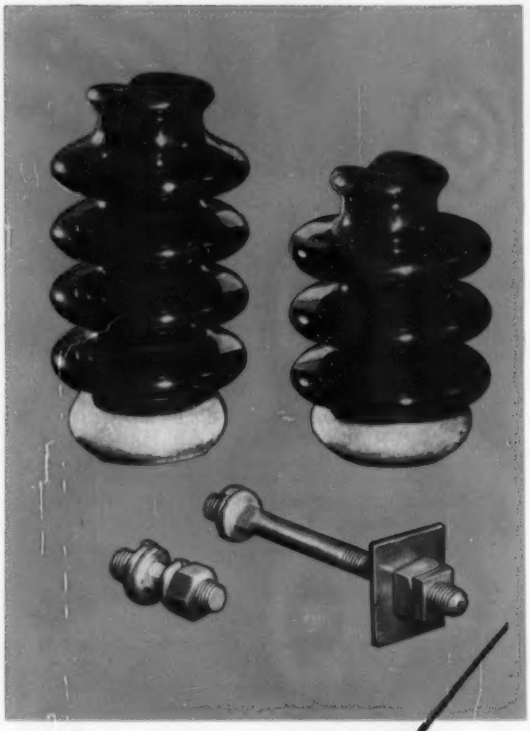
STANDARD OIL COMPANY
(Indiana)

STANDARD

NOW!

LAPP LINE POST PERFORMANCE

for your distribution lines



The Lapp Distribution Post is available in units of two sizes, the over all heights being 7" and 9". Separable studs . . . of any desired length. In addition, a special low-priced galvanized steel pole top bracket is offered specifically for use with these insulators. With either unit, it develops the full 1500 lb. cantilever strength at the top of the insulator.

New Lapp Distribution Post insulators are "baby" Lapp Line Posts—and priced in the range of distribution insulators. At duty up to 25 Kv, they offer the trouble-free kind of operating service that has been characteristic of Lapp Line Posts.

SOLID ONE-PIECE PORCELAIN. The body is a solid porcelain, machine-finished all over including conductor and tie wire grooves. Base is externally attached and studs are interchangeable—any required length being available.

FOG-TYPE. Multiple short petticoats, characteristic Lapp Fog-Type design, provide an exposed uniform leakage path and self-cleaning feature—most efficient for duty in contaminated atmosphere.

LIGHTNING- AND MECHANICAL-ATTACK RESISTANT. Short sturdy petticoats—such as have been proved by nearly 25 years of service on Lapp Line Posts—provide greatest protection from damage by arcover and attack by stones or bullets.

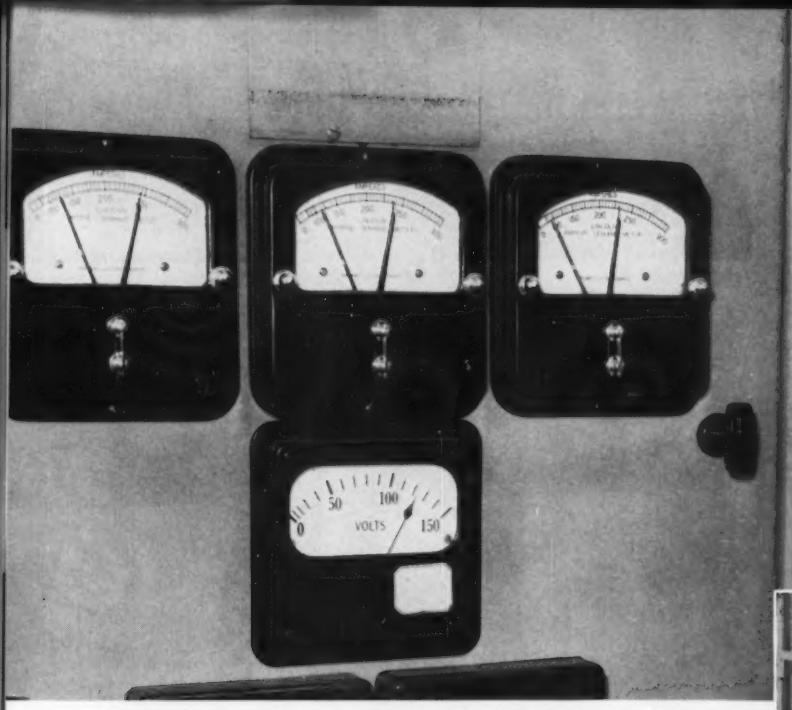
NO CRACKING. The porcelain, held in the large-area low-intensity grip of its cemented-on base, can be loaded only in compression. No internal bursting forces can develop—permanently free from cracking.

PUNCTURE-PROOF. Solid electrical porcelain from conductor to base—no internal conductive pins, or even air space. Completely puncture-proof.

RADIO-FREE. The Lapp Post, by design, is inherently and permanently free from television or radio interference—requires no treatment or coatings.

WRITE for full description and specifications, Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp



THESE LINCOLN TYPE AD-2 Semi-Flush Switchboard Meters provide continuous information on feeder load and balance in an attended substation.

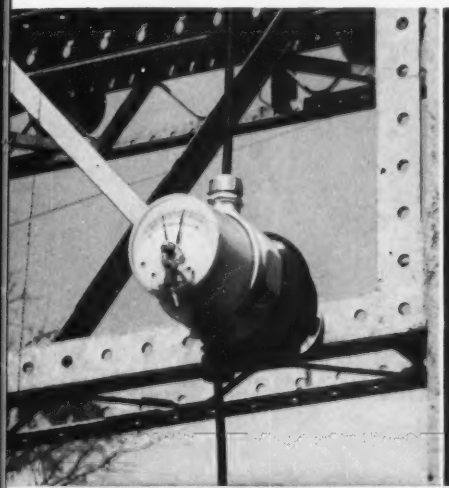
USE AD* MEASUREMENT FOR SYSTEM BETTERMENT

Helps you keep loads balanced to get the most out of system and distribution capacity

Lincoln Ampere Demand (AD*) Meters of the indicating type give you—at very low cost—the continuous information you need to load your distribution system to the ultimate safe limit. For the full story, just write Sangamo for information on "AD Measurement for System Betterment."

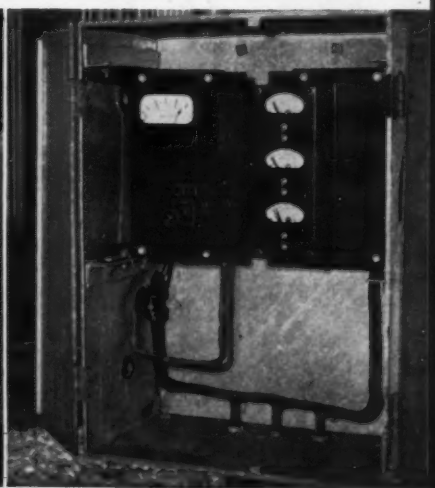
SANGAMO ELECTRIC COMPANY • Springfield, Illinois

LINCOLN ADS SOCKET TYPE Meters show loading and balance on phases in an outdoor substation.



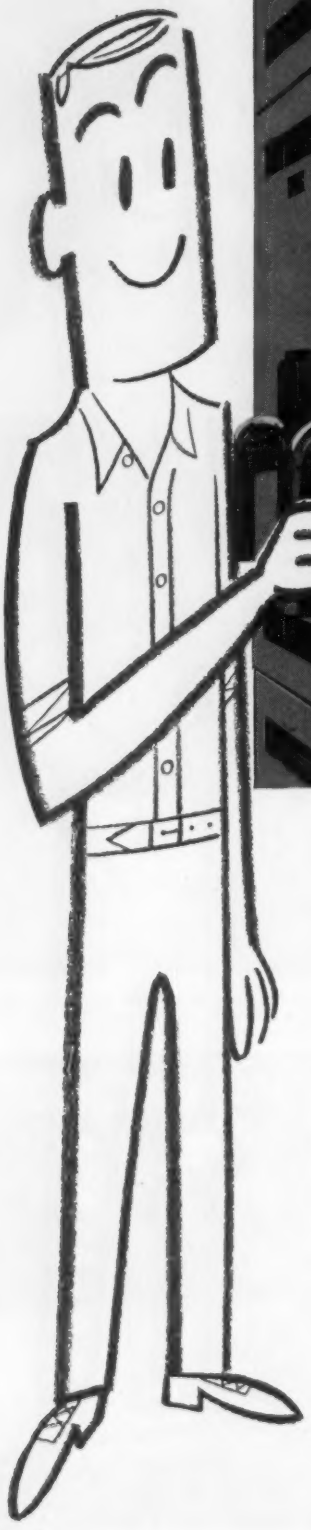
THIS "HOT" TYPE AD-5 Lincoln Meter indicates amperes and balance on primary feeder circuits. Meter is insulated from ground with a post-type insulator and is arranged for hot stick reset.

THIS LINCOLN ADN METER gives continuous facts on the load magnitude and load balance of "Y" connected transformers. No instrument transformers are necessary.



A TRIPLEX AD-2 INSTALLATION that shows load balance and current values on 4800 volt feeders in an outdoor substation.

SMS6-1



Now a new standard of safety in low-voltage switchgear

Test position with doors closed

This exclusive I-T-E low voltage switchgear feature establishes a new standard of safety in testing circuit breakers. It offers the additional advantages of reduced handling; less maintenance; convenient "tagging out"; better dust protection; easier circuit identification. And all are yours at no increase in cost in the compact, modern design of I-T-E low-voltage switchgear.

For complete information, contact your nearest I-T-E sales office. Or write for Bulletin 6004B. I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY
Switchgear Division

ANOTHER REASON WHY UTILITIES EXPECT MORE FROM POWERS-AMERICAN DERRICK EQUIPMENT

MOST ADVANCED HYDRAULIC DERRICK EVER BUILT

POWERS American

PROUDLY PRESENTS

the Sensational

New Pole-Master PM-2

HYDRAULIC DERRICK

The new PM-2 offers *more* outstanding operating characteristics than *any* derrick ever made. It utilizes the most desirable features of the famous *HD-2* and *HD-4* Pole-Master Derricks . . . has a unique new design that's destined to set a new standard for fully-powered derricks. You'll like everything about the new PM-2 . . . especially the time and money it saves. Three sizes: for 40′ poles, for 55′ poles, and for 75′ poles.

LOOK AT THESE OUTSTANDING FEATURES:

Completely fool-proof operation • "Live" boom can be moved under load • Operating arc *well in excess* of 180 degrees • Requires only single-drum winch • Head sheave can be threaded from ground • No center leg or exposed mechanism • Does not obstruct cargo area or rear of body • Operated by one double-acting control valve • Permits complete closing of body roof.

McCABE-POWERS

AUTO BODY COMPANY

5900 NO. BROADWAY, ST. LOUIS, MO. 625 CEDAR ST., BERKELEY 10, CALIF.

Bulletins describing Pole-Master Derricks —Series PM-2, Series HD-2, and Series HD-4—will be sent, with price information, upon request. No obligation, of course!

This trolley design lowered first costs 30%

This is the 235 ton Powerhouse Gantry Crane built by Paceco for Pacific Power & Light Co., Ebasco Services, Inc., engineers.

Paceco's single trolley design for cranes over 150 ton capacity reduced initial cost 30%-40% below double trolley designs using lifting beam.

Besides economical first cost, the crane has proved low maintenance record. These are Paceco's standards for *every* crane we build. This is why Paceco "tailors" each crane to maximum advantage to the *owner!*

May we harness our nationwide experience-built skills to serve you? We invite your inquiry.

Besides cranes of all types, Paceco designs and builds hoists, high pressure gates and valves; intake gates. May we send you our illustrated brochure on all these products?

PACIFIC COAST ENGINEERING COMPANY

ENGINEERS · MACHINISTS · FABRICATORS

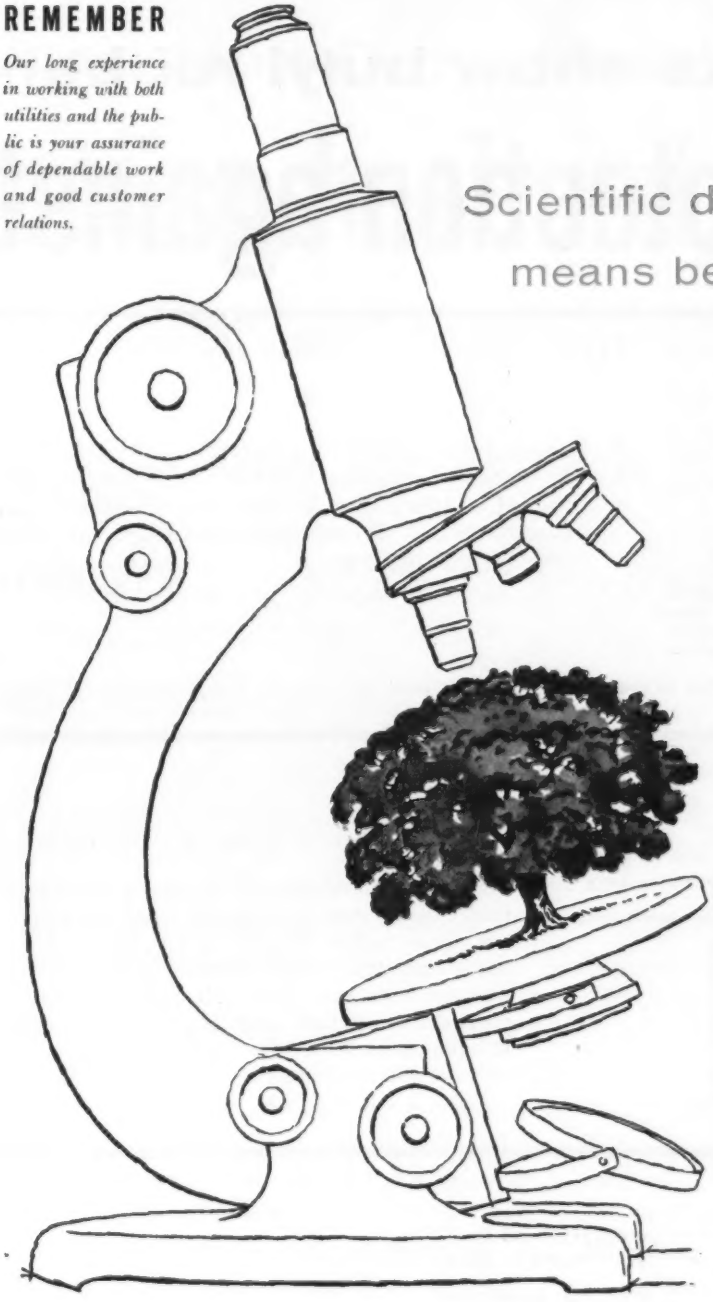
Alameda, California, Lakehurst 2-6100
3018 E. Foothill Blvd., Pasadena 8, Calif., RYan 1-9373
PACIFIC COAST ENGINEERING COMPANY, INC. 51 E. 42nd St., New York 17

PACECO

"TAILORS OF STEEL"®

REMEMBER

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.



Scientific diagnosis means better tree care . . .

The basis of any curative treatment for either plants or animals is accurate diagnosis, plus the skill and experience to bring it to a successful conclusion. This means research, not guesswork as well as the best of equipment and ability.

You won't see many tree laboratories comparable to our 200-acre experimental ground and research unit at Stamford, Connecticut, where the day-to-day problems encountered by our field men are diagnosed and ideas for the protection of shade trees are tested and developed under actual growing conditions. These laboratories call for a big investment in both time and money. But to us who want to be sure of results, this painstaking research for the best possible treatment is worth it.

Couple this with an efficient highly skilled field force, thoroughly familiar with local conditions, and you have the well balanced Bartlett organization capable not only of rendering scientific diagnosis but of executing the prescribed treatment in efficient, economical fashion. It is the reason why more and more people are turning to the Bartlett Way—the Scientific Way. It costs no more and it is safer and more economical in the long run.

Consult your local Bartlett representative today for a study of your tree situation. You will benefit by his recommendations.

The Bartlett Way

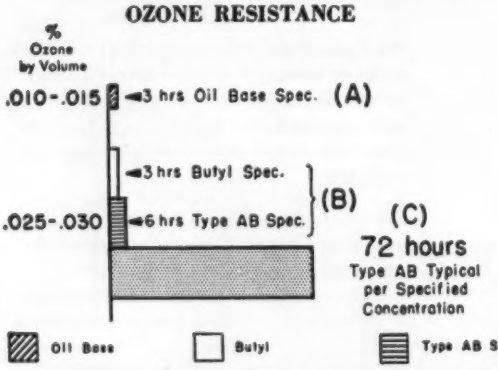
BARTLETT TREE EXPERTS

Home Office, Research Laboratories and Experimental Grounds, Bartlett School of Tree Surgery, Stamford, Conn.
Local Offices from Maine to the Carolinas, and West to Indiana.
See your Local Telephone Directory for Local Address.

3 tests show butyl rubber-

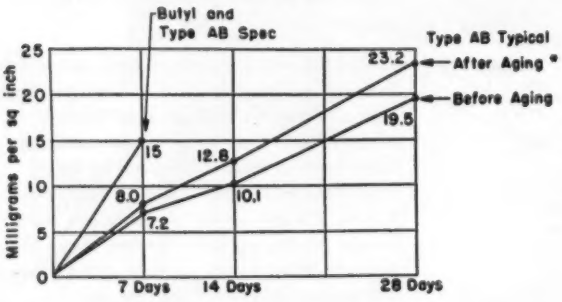
Extra protection against

OZONE RESISTANCE



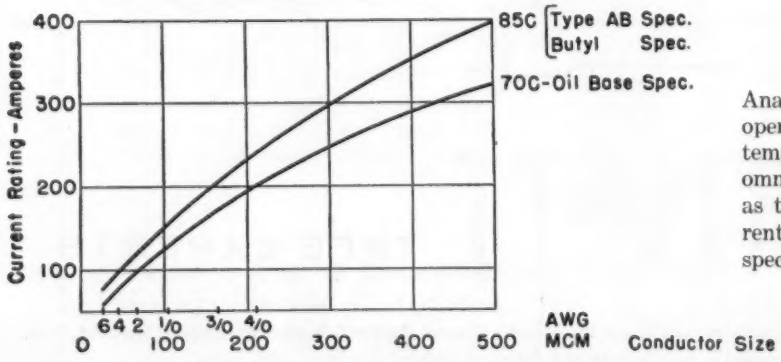
In standard ozone-chamber test, Type AB insulation showed no injury after 72 hours in 0.025-0.030% ozone concentration . . . 24 times longer than required by oil base and butyl specifications.

MOISTURE ABSORPTION



For the mechanical moisture absorption test, the industry has regarded 15 milligrams increase in weight per square inch of exposed surface, after 7 days' immersion at 70C, as a criterion for satisfactory moisture resistance. Type AB easily meets that requirement—in fact, after 28 days of immersion it is only a fraction above the 7-day requirement.

OPERATING TEMPERATURE



Anaconda recommends Type AB for operation at 85C maximum operating temperature. Industry standards recommend 70C for oil base. That means, as the graph shows, Type AB's current-carrying capacity exceeds oil base specifications by 22%.

insulated Durasheath* Cable has

ozone, heat and moisture

Anaconda exclusive Type AB butyl rubber insulation resists ozone far longer than needed to prove its high ozone resistance . . . absorbs far less moisture . . . has 22% more current-carrying capacity.

Standards are set up for your protection—but most standards state minimum requirements.

Anaconda's Type AB butyl-insulated cable performance exceeds its own specification requirements and goes far beyond industry requirements—gives you an extra margin of protection against the major enemies of long cable life.

Butyl rubber has *inherent* resistance to ozone, heat and moisture. Thus Anaconda has been able to concentrate on the development and improvement of other desirable properties.

The pay-off is in your operations—in longer cable life . . . in less maintenance . . . in lower over-all operating costs. The Man from Anaconda will be glad to give you full details about Type AB-insulated Durasheath and other Type AB-insulated high-voltage cable. Why not call him today? Or for more information, write Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U. S. Pat. Off.

PIONEER IN BUTYL INSULATION **ANACONDA®**

For Greatest Reliability over

it's PHILCO POWER

10 times more microwave power gives

EXCLUSIVE WITH PHILCO! Ten times more transmitter power in Philco CLR-7 Microwave systems . . . with a degree of performance and reliability never before attained in microwave equipments.

Heart of the Philco system, the "Power House" Klystron, generates a full watt of power (10,000 watts ERP) in the preferred 6000-7500 mc band.

This Philco CLR-7 Microwave power results in a received signal 10 times stronger—a higher safety margin to overcome adverse propagation conditions.

Philco CLR-7 Microwave equipment can be installed in minimum space... employs reliable, long-life tubes, a positive frequency control system and is completely compatible with existing wire line and two-way radio facilities *and with any type multiplex equipment.*

Get complete data on CLR-7 Microwave equipment. Let Philco help in the planning of your system. Philco maintains a staff of microwave specialists who are experienced system and field engineers. Call a Philco field representative or write Philco, Dept. EW, today.

PHILCO REGIONAL SALES OFFICES

CHICAGO 11, ILLINOIS
666 Lake Shore Drive

LOS ANGELES 25, CALIF.
10589 Santa Monica Blvd.

DAYTON 2, OHIO
Talbott Bldg.

SAN FRANCISCO 3, CALIF.
1355 Market St.

WASHINGTON 6, D.C.
744 Jackson Place, N.W.

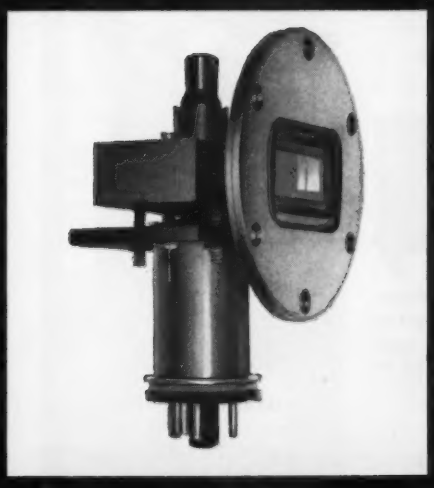
DALLAS 1, TEXAS
201 Southland Life Bldg.

the "Long Haul"

THAT COUNTS!

you advantages like these:

- 160% greater maximum hop distance
- Fewer microwave relay stations
- 10,000 watts effective radiated power—50% smaller antennas
- Reduced tower installation costs
- 10 db additional signal safety margin



Philco CLR-7 Microwave repeater . . . rugged! compact! reliable! Built to provide continuous, trouble free service over short or long hauls.

Philco "Power House" Klystron provides the highest equipment power output available in the preferred 6000-7500 megacycle band.

PHILCO CORPORATION

Government and Industrial Division

Philadelphia 44, Pennsylvania

In Canada: Philco Corporation of Canada Ltd., Don Mills, Ontario • In Europe: Philco Corporation, Paris, France.

OVER 400 RATINGS

Select Your Instrument Transformer Needs from Wide Range of Types

Get top quality, wide selection, quick delivery from Allis-Chalmers! Select dry-type, oil or compound-filled units, depending on transformer rating, application and location indoors or out.

Features include liberal electrical design on all types. High voltage types incorporate corona-free design. All Allis-Chalmers metering transformers have high accuracy.

Get Dimension Sheets

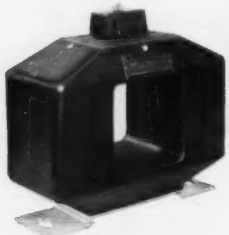
All pertinent mechanical and electrical information is in convenient data sheets. It is yours for the asking. Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Outdoor current transformer, type KO, rated up to 15 kv, 800 amp.

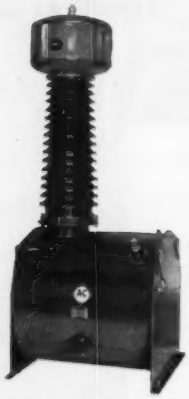
Molded current transformer, type BKM for 1200 and 1500 ampere indoor or outdoor use, 600 volts.

Molded current transformers, type TWM for 200, 400, 600 and 800 ampere, indoor or outdoor use, 600 volts.

Oil-insulated outdoor current transformer, type SCW for 25 kv to 138 kv.



Molded current transformers, type BKM for 2000, 3000 and 4000 ampere application, 600 volts.



Oil-insulated outdoor potential transformer, type SPW for 25 kv to 138 kv.

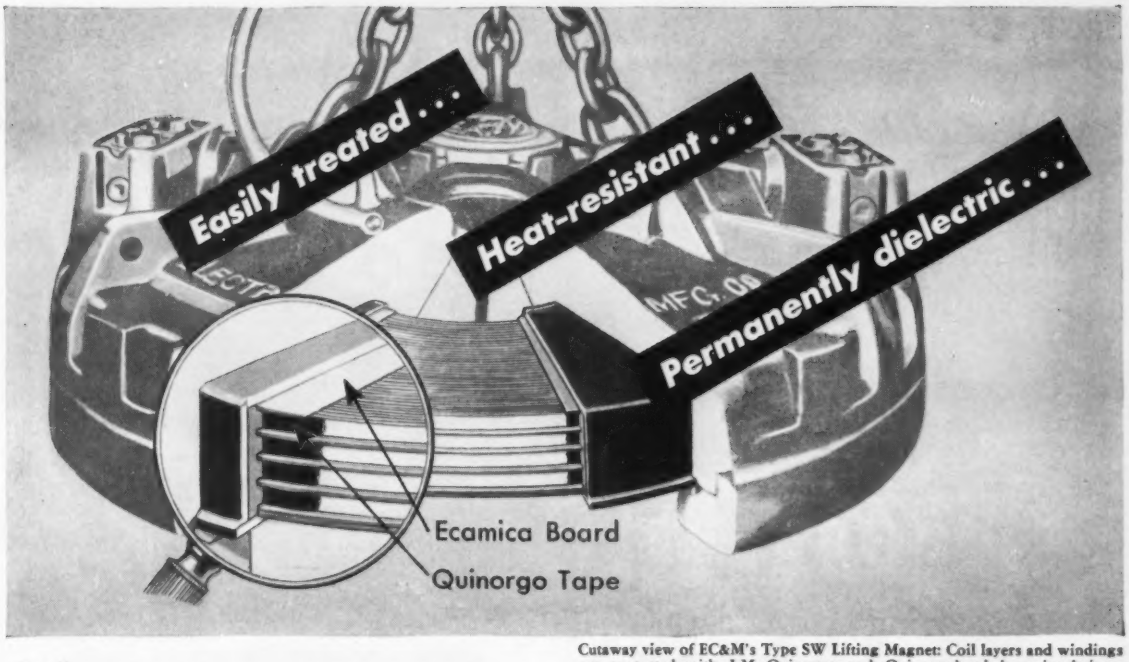
Indoor potential transformer, type PD, rated up to 14,400 volts, fused or unfused.

NATIONAL ELECTRICAL WEEK — FEBRUARY 5-11

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-4958

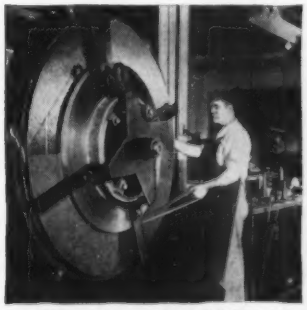


Cutaway view of EC&M's Type SW Lifting Magnet: Coil layers and windings are protected with J-M Quinorgo and Quinorgobord base insulations.

3 important reasons

why both Quinorgo® and Quinorgobord® are used in EC&M magnets

Quinorgobord No. 1100 is impregnated and laminated by special EC&M processes into their ECAMICA Boards for coil layer insulation.



Quinorgo Tape No. 3000 is impregnated with compounds developed by EC&M and wet wound simultaneously with strap copper.

AFTER MANY TESTS of materials available, The Electric Controller & Mfg. Co., Cleveland, Ohio, selected both Johns-Manville Quinorgo and Quinorgobord, for use in their all-welded lifting magnets.

These materials provided the desirable and efficient mechanical and electrical properties needed for magnet duty. Each remains dielectrically stable under heat. Both are exceptionally free from magnetic particles and low in moisture content. Especially designed for treatment with other dielectrics, they are tough, relatively moisture-free, base materials.

No. 3000 Quinorgo Tape insulates the strap wound coils. Its excellent space factor permits a higher number of turns of copper, resulting in greater lifting power. By a special EC&M process, No. 1100 Quinorgobord (a board-like sheet) is treated and combined with Mica to form ECAMICA* board. This, they use between the coil layers.

Other leading manufacturers, processors and laminators also find that these moderate-priced J-M pyrolysis-resistant electrical insulations help cut costs, improve insulation performance and lengthen service life of equipment. For complete information, write for booklet EL-40A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

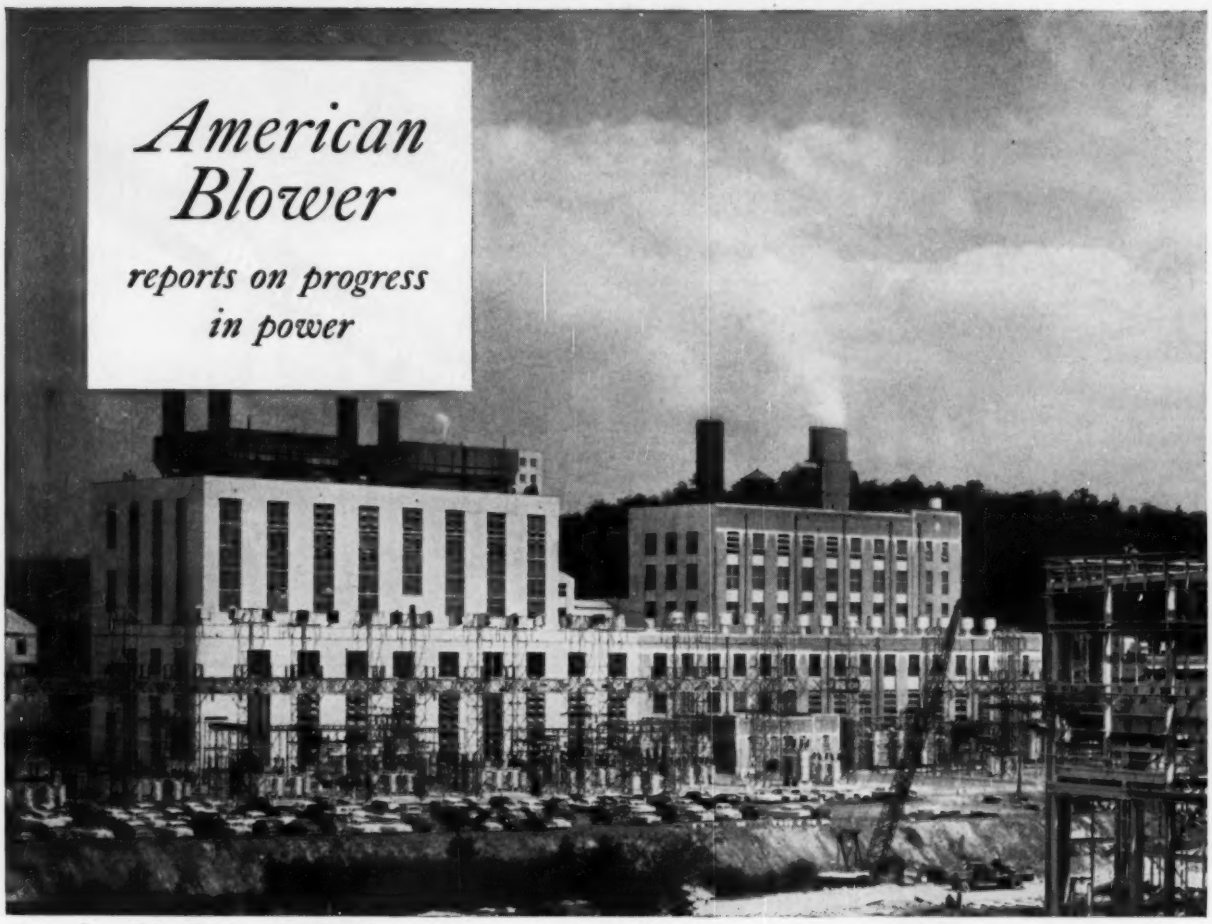
JOHNS-MANVILLE JM PRODUCTS

**Registered Trade Mark of Electric Controller & Mfg. Co.*

Johns-Manville
ELECTRICAL INSULATIONS

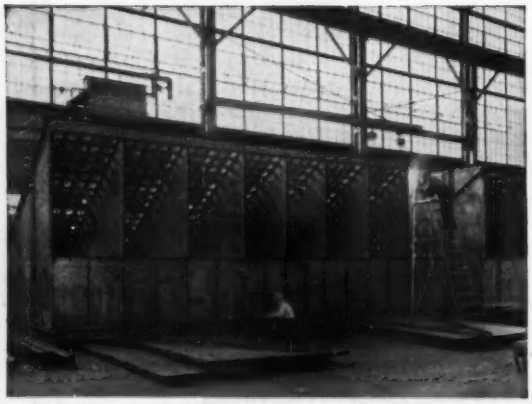
American Blower

reports on progress in power



Gorgas Steam Plant No. 2, with 428,000 hp capacity, is on the Warrior River. Plant No. 3 (right), under construction, will house

Alabama Power ups capacity to



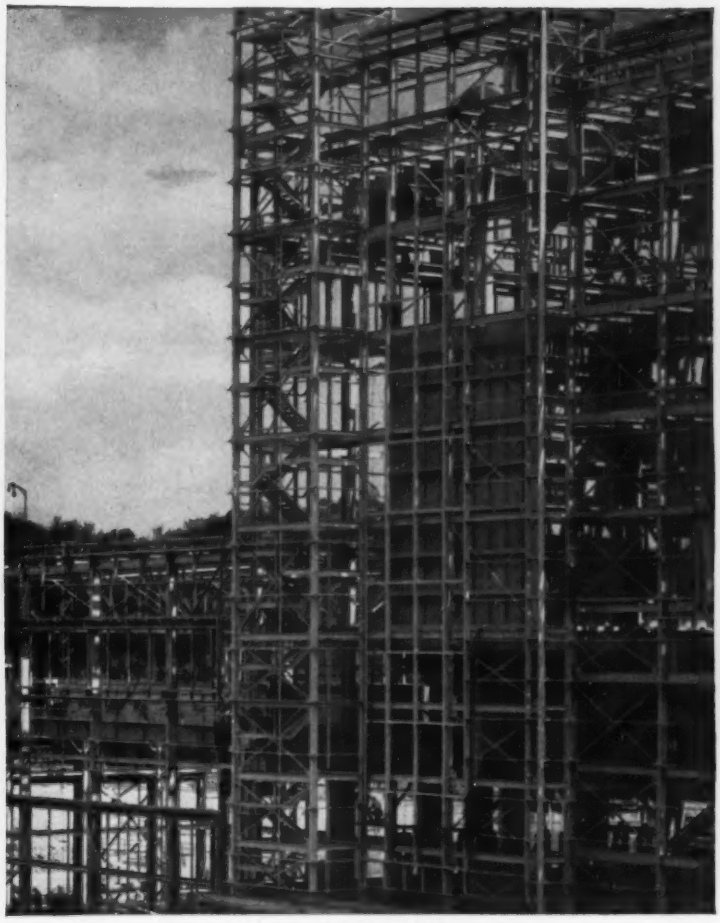
While Gorgas Steam Plant No. 3 is being built, American Blower constructs two Fly Ash Precipitators which will be installed in this new plant. Ratings: 340,000 cfm @ 285° F.

As in the past, Alabama Power installs American Blower equipment—in building for the future

With six steam and six hydroelectric plants, the Alabama Power Company forges ahead for the future of Alabama. In 1955 alone, it will invest more than $35,000,000 in bigger and better electrical facilities, including an eighth generating unit at their Gorgas Steam Plants. When completed this year, Alabama Power's capacity will be over 2,000,000 hp!

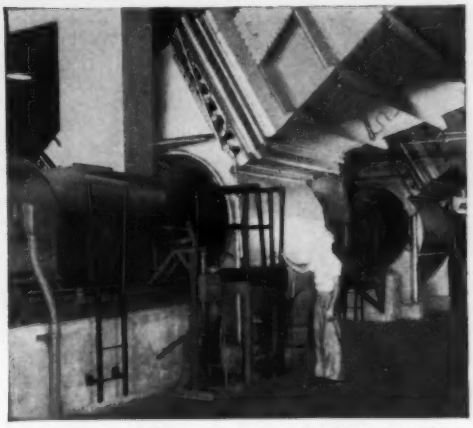
American Blower Forced and Induced Draft Fans, Fly Ash Precipitators and Gyrol Fluid Drives are being installed in this new plant.

From coast to coast you'll find American Blower playing an important role in the expansion and modernization of many other progressive, investor-



No. 8 generating unit, rated at 208,000 hp.

Gorgas Unit No. 7 uses American Blower Fans with Gýrol Fluid Drives. Induced Draft Fans (above) are rated @ 262,500 cfm @ 270° F @ 15.25" sp @ 569 rpm.



American Blower Forced Draft Fans on Unit No. 7 at Alabama Power's Gorgas Steam Plant are capable of 180,000 cfm @ 140° F @ 11.00" sp @ 868 rpm.

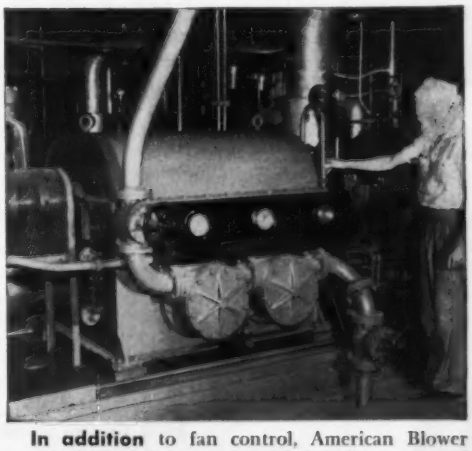
over 2,000,000 hp!

owned utilities. Plant operators have come to rely on American Blower Heavy-Duty Steam Coils and Fly Ash Precipitators, as well as our Mechanical Draft Fans, Dust Collectors, and Gýrol Fluid Drives for boiler-feed pump and fan control.

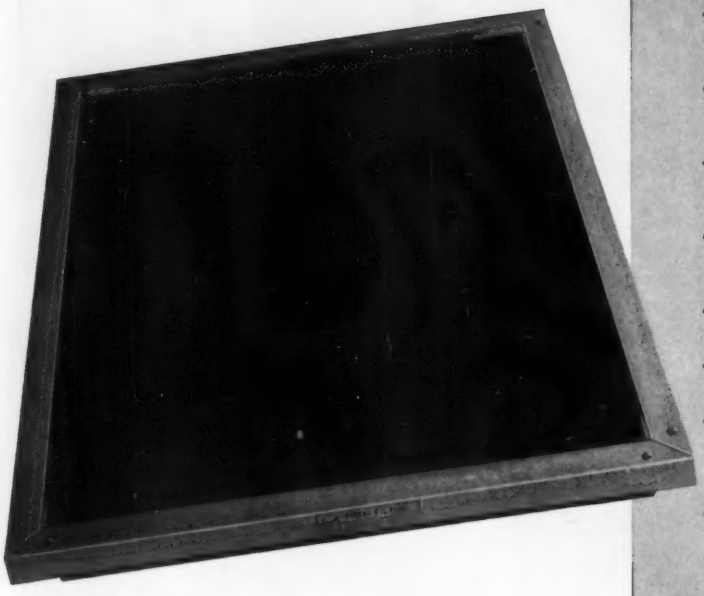
Give us a call to discuss *your* program. An experienced representative will gladly go over your requirements, and recommend equipment of the highest efficiency and economy. Contact your American Blower or Canadian Sirocco Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American-Standard

AMERICAN 75th ANNIVERSARY YEAR 1881 - 1956 **BLOWER**



In addition to fan control, American Blower Gýrol Fluid Drives — class VI, 1500 hp — are used for adjustable speed control of boiler-feed pumps.



*

Sales Feature . . . **Uniform Heat**

The entire surface of our panel radiates heat.

Sales Feature . . . **Economy**

Efficiency up to 80% means minimum operating cost—makes electrical heating practical for large areas.

Sales Feature . . . **Safety**

No glowing wires or coils—and there's no water needed. PYREX brand glass is strong.

Sales Feature . . . **Cleanliness**

Corning panels don't attract dust—have no combustion waste.

Sales Feature . . . **Comfort Control**

Each room can have the amount of heat it needs right to the degree.

Sales Feature . . . **Fast Heat**

Corning panels radiate infrared rays that convert to warmth fast.

Sales Feature . . . **Silence**

No moving parts.

Sales Feature . . . **Space Saving**

A complete unit need be only 2 or 3 inches deep.

Sales Feature . . . **Easy Installation**

You can design heaters with Corning Radiant Panels for installation with no complicated wiring or wall preparation.

Sales Feature . . . **Pre-Acceptance**

Consumers know that the PYREX trade-mark identifies dependable value. This helps you gain high acceptance with a new product — right from the start—with consumers, dealers, distributors.

PYREX E-C panel's sales features are helping to create wider acceptance for electric heating

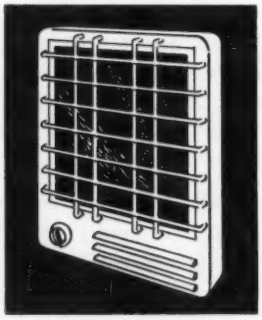
Take all the reasons for having electric heat. Add to them the sales features of the PYREX E-C panel.

You'll have a doubly-impressive collection of features to build demand for electric heat installations in new homes . . . additions . . . expansions . . . auxiliary heating . . . emergency heating . . . and portable heating.

The PYREX E-C panels supply the sales edge in the way they perform. We make them of a PYREX brand glass with a conductive, metal oxide coating bonded to the back surface. They emit infrared energy with a high degree of efficiency. They're mechanically strong and thermally rugged. And their electrical characteristics are excellent. They can be used as high temperature, 2,000- and 3,000-watt units for permanent space-heating installations. Also current surge on starting is low.

To learn all about Corning PYREX E-C Panels and how you can use them to increase the use of electric heating, write, wire or phone Corning Glass Works.

If you are interested in using these PYREX E-C panels as components in new heaters, we'd be delighted to talk it over with you.



Standard panel sizes: 8" x 36", 12" x 16" and 16" x 24" are available. Other sizes to order.

CORNING GLASS WORKS, CORNING, N. Y.
39-2 Crystal Street

Corning means research in Glass

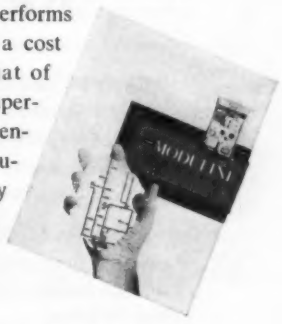
...AN EFFICIENT SUPERVISORY DEVICE FOR REMOTE 24-HOUR-A-DAY MONITORING ELECTRIC TRANSMISSION AND DISTRIBUTION SYSTEMS...

The Sprague Moduline Monitor is a power line carrier system designed for monitoring operation of oil circuit breakers, transformers, switches and other equipment in unattended substations on Transmission and Distribution Circuits.

The Moduline Monitor provides system operators and management with practical, flexible monitoring equipment to give instantaneous knowledge of changes in system conditions.

A single Moduline Monitor is capable of supervising up to 25 points or functions from a remote location—using only ONE carrier channel.

The Moduline Monitor performs its important functions at a cost considerably less than that of other multipoint carrier supervisory systems. A comprehensive description of the Moduline Monitor and its theory of operation is contained in Sprague Bulletin MD-7002. Send for your copy



SPRAGUE MODULINE MONITOR

THE MODULINE DIVISION OF THE
SPRAGUE ELECTRIC COMPANY • 315 MARSHALL STREET • NORTH ADAMS, MASS.

ASBESTOS CORD made by K&M especially for flare parachutes exemplifies high quality of K&M asbestos textiles. Other K&M asbestos cords are used in electric motors, for wire wipers, and for insulation of glass-handling tools.

Nature's "miracle" fiber—tailored to your needs

K&M ASBESTOS TEXTILES

Whether it's used in a fire-fighting suit, spun into cords for parachute flares—woven into cloth, tape or thread for electrical insulation—asbestos serves better than any other material found in nature or devised by man.

Keasbey & Mattison selects the finest grades of asbestos fibers and weaves them into textiles that are recognized for their uniformity of weave and thickness.

K&M has the know-how to tailor-make any special asbestos items you may require—promptly, and with fidelity to specifications. Choose K&M asbestos textiles in any of their varied forms: yarn, roving, thread, tapes, cloth, tubing, wick packing, twisted and braid rope packing, safety garments. They're backed by more than half a century of research and development experience.

We'll gladly help with any insulating problem you may have. Write or call us any time.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

In Canada: Atlas Asbestos Company, Limited; Montreal, Toronto, Winnipeg and Vancouver

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

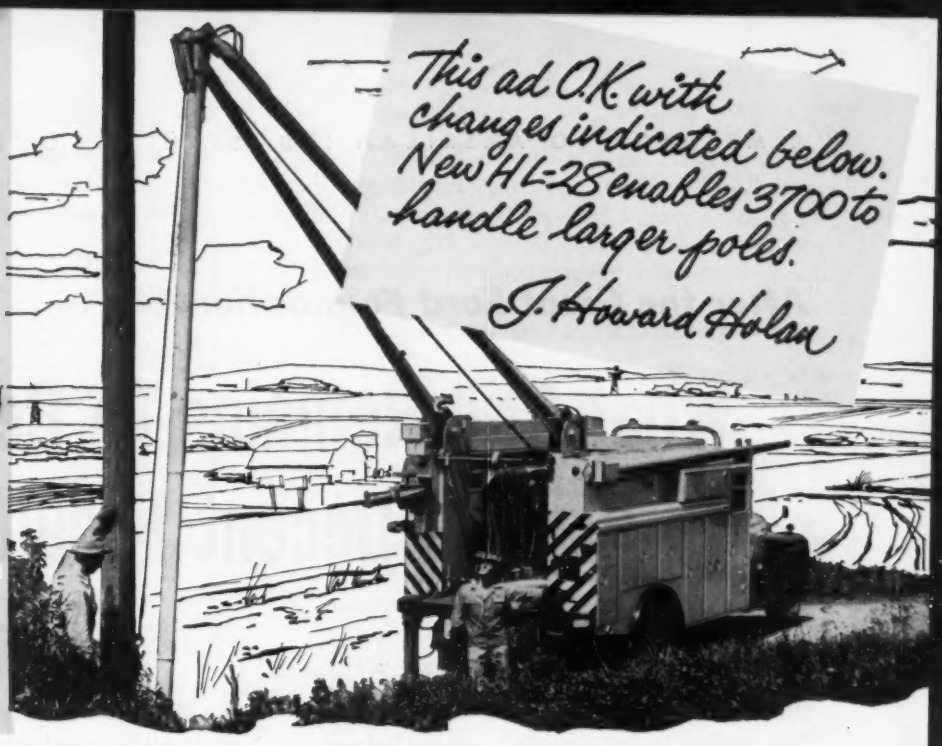
Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 75", 84", 90" and 102".

Tree trimmer body accommodates 7-men crew. Aerial and winch equipment optional. Side rack hinges for easy unloading of brush.

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

Holan 3700 Heavy-Duty Live-Boom Power Derrick is illustrated with stiff-leg integral removing pole from ground. Rated safe-load capacity of 12,000 pounds exceeds all previous derricks of its type; loads body under power with maximum 3,000 pounds. For big lifts, Holan Self-stowing Hydraulic Jacks are recommended.



This ad O.K. with changes indicated below. New HL-28 enables 3700 to handle larger poles.
J. Howard Holan

GREATEST "LIFT" MONEY CAN BUY!

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.

Portable mechanical and hydraulic earth borers with optional rotation.

Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

Holan-engineered to hoist loads never before achieved by a live boom power derrick, this mighty hydraulic weight-lifter handles burdens up to 6 tons! Powerful double-acting cylinders offer plenty of brawn to tote ~~70-foot~~ 75-foot poles and "H" frames.

A working range of 195°, from over-the-cab storage to a five-foot head height for easy winch line threading, combines versatility with strength. Power body-loading capacity of 5000 pounds is also an important feature. Super-sensitive throttle controls at rear of truck put you in complete command of speed and position of the derrick at all times . . . easy as handling a toy train! Protection of crew and equipment is assured by numerous safety-engineered features.

If pole setting and other weighty jobs are over-taxing your crew and equipment, you'll want to see this super heavyweight in action building efficiency and morale, and reducing costs. Yes, a Holan Series 3700 Heavy-Duty Power Derrick will soon earn its own way on your team. Write for ~~more details~~ new catalog now available.

Also available in our new Griffin, Ga. plant

"You"-tility Engineered by J. H. HOLAN CORPORATION

4100 WEST 150 ST. • CLEVELAND 11, OHIO

THE NAME THAT MEANS WORK SIMPLIFICATION

After the Great Ford Foundation Gift . . .

What Still Remains To Be Done To Provide Decent Faculty Pay

The Ford Foundation's gift of a half billion dollars to our privately supported colleges, medical schools and hospitals, now being distributed, is magnificent. But it will be much more magnificent if it inspires completion of the job to which it gives a lift. So far as the colleges and universities are concerned, this job is primarily to rescue their faculty members from being second-class citizens economically.

Even in a period when we have become accustomed to astronomical financial figures, a half billion dollars remains an eye-popping gift. In fact, it is so imposing that a good many people who don't read the fine print are apt to conclude that it must just about solve the financial problem to which it is addressed.

Goes Only a Small Way

However, we have allowed college professors to fall so far behind the parade financially that the share of the Ford half billion dollar gift going directly to the improvement of faculty salaries ($210 million) will go only a small way financially toward doing what is necessary to provide adequate salaries.

Completion of this job for our privately supported colleges and universities calls for:

1. An increase in faculty salaries at least five times as great as that made possible by the Ford gift merely to restore salaries to their 1939 purchasing power level and an increase fifteen times as great to provide adequate salaries today.

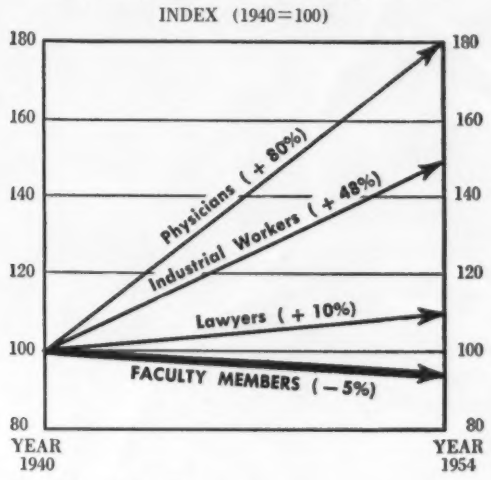
2. Some difficult and courageous decisions by the heads of the colleges and universities in apportioning the grants received by them.

Terms of Gifts to Colleges

The $210 million of the Ford Foundation gift going specifically to improve faculty salaries is being distributed on the following basis: Each of 615 privately supported, regionally accredited liberal arts and science colleges and universities receives a gift about equivalent to its last year's teaching payroll. For ten years only the income from these gifts is to be devoted to raising faculty salaries. After that all the money can be spent in any way the institutions receiving it see fit. There is no requirement that universities having other than liberal arts and science schools limit use of the gifts to improving salaries in these schools alone. They can spread it right through all their faculties if they wish.

In addition to the gift of $210 million specifically directed to increasing faculty salaries, another gift of $50 million goes to a group of 126 institutions selected for specially noteworthy leadership in improving

What's Happened to College Faculty Salaries*



* Real Income before Taxes.

Source: Council for Financial Aid to Education, U. S. Dep't of Commerce: U. S. Dep't of Labor.

the status and pay of teachers. For these schools the individual gifts add about 50% more to the amounts coming from the $210 million fund. They can be used to improve faculty salaries if the institutions choose to do so, but this is not required by the terms of these gifts.

The $210 million plus the $50 million should yield an income of $10-$13 million a year. Even if all this is used to raise salaries, it will be only a small step, however worthy, toward the $200 million per year the colleges need to meet their salary requirements adequately.

Helps Some Who Need It Most

In focussing its gift to improve faculty salaries in privately supported liberal arts and science colleges, the Ford Foundation aims at least part of the help at the spot where it is most desperately needed. Numerous surveys have indicated that the most poorly paid of all college and university faculty members are those in small, privately endowed liberal arts colleges.

But the overshadowing fact is that the teachers in our colleges and universities as a whole are badly underpaid. Just how badly is indicated by the chart above which first appeared in an earlier editorial. (Figures later than those for 1954 are not available.)

The Ford gift will turn the indicator of faculty salaries, which now lies far below the general salary trend, upward a few points. And it will do this in some places where salaries are below the wretched average shown by the chart.

But the Crucial Test Remains

College and university administrators will have the opportunity to extend further the process of getting the help provided by the Ford Foundation gifts where it is most needed. In general, this will mean giving it to senior faculty members, in order to hold experienced teachers and make college teaching attractive as a career. But to make such a division in many schools will take extraordinary fortitude.

The crucial test of the success of the enterprise of the Ford Foundation in raising faculty salaries will lie in whether it prompts the rest of us — college alumni, individuals, business firms and legislators alike — to see that it is a great beginning, not a signal for a recess.

Even with the Ford gifts providing $10-13 million a year, our privately supported colleges and universities must have an increase of about $190 million a year to provide decent faculty salaries.

This is a job far beyond the capacity of the Ford Foundation, imposing though that is. It is a job far beyond the capacities of a few hundred large corporations and a few thousand wealthy individuals. If it is to be done, it is a job at which all of us must work with a will.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

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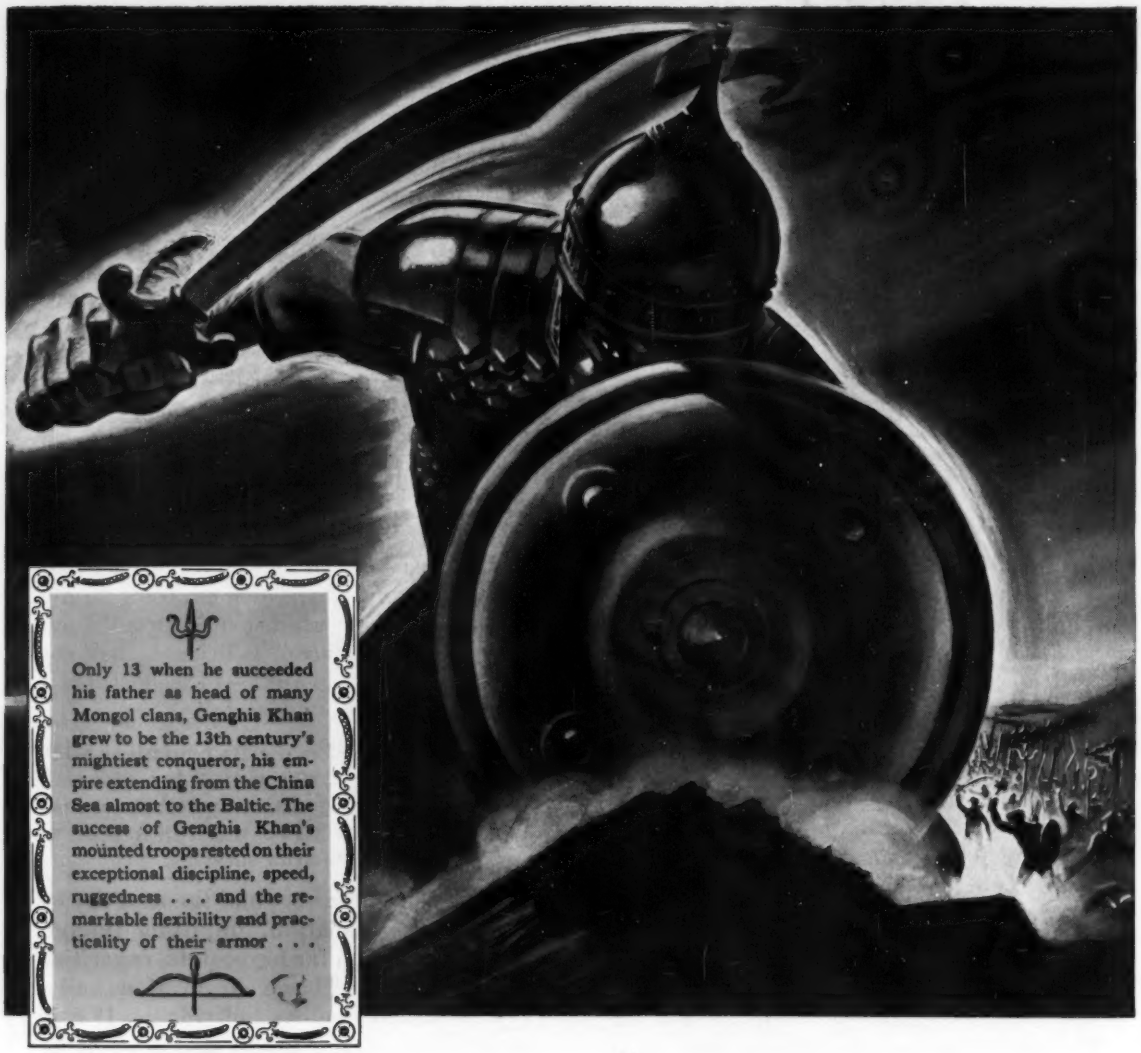

Only 13 when he succeeded his father as head of many Mongol clans, Genghis Khan grew to be the 13th century's mightiest conqueror, his empire extending from the China Sea almost to the Baltic. The success of Genghis Khan's mounted troops rested on their exceptional discipline, speed, ruggedness . . . and the remarkable flexibility and practicality of their armor . . .

PROTECTED... against constant enemies

Flexibility and *practicality*, important characteristics of armor in Genghis Khan's day, can refer as readily to a modern-day kind of protection—Kerite Cable's never-equalled, never-surpassed insulation. Moreover, Kerite's endurance and resistance to constant attack truly would be a credit to one of those intrepid 13th century Mongol guardsmen.

Kerite Cable has to stand the test of not one enemy, but many—not for days or months, but for 30, 40, 50 and more years. Water, heat, cold, sun, deteriorating elements, time itself—these and more find Kerite an invincible opponent.

Wherever it is used, the world over, Kerite performs perfectly, lasts almost indefinitely. That is the reason wise buyers specify it.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 390 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

Founded 1854

EDITORIALS

This Is National Electrical Week

"Good morning. This is National Electrical Week."

Switchboard operators at electric utilities over the nation may want to greet callers with this salutation during the week. It would be one way of reminding the public of the occasion.

Objectives in designating this as National Electrical Week are three fold:

1. To focus attention on the contributions of electricity to our society and the contributions of the electrical industry to our economy.

2. To emphasize the safety aspects of adequate home wiring.

3. To encourage appropriate recognition of pioneers who helped build the electric industry of today.

These worthy objectives merit support from every segment of the industry. Designation of the week affords a grand opportunity for the industry to put its best public relations efforts forward.

Because of the relatively short notice given in connection with the observance this year few utilities have had time to put together a comprehensive program. We will carry a report on activities at Union Electric Co in an early issue. For those who have not been able to participate this year, the week will have partially served its purpose if it spurs them to start planning now to take full advantage of the opportunity next year.

Unity in the Engineering Profession

In accepting an honorary membership in the American Institute of Electrical Engineers last week, James F. Fairman, vice president of Consolidated Edison Co, offered these sage comments on unity of the engineering profession:

"In my opinion, based on some 20 years of work and observation in that field, our principal obstacle is our concern for the mechanism of unity, the forms of organization. We exhaust ourselves in fruitless arguments about how to organize to do what needs doing when we should be concentrating our efforts on doing what needs doing.

"If we could only learn to cooperate, individually and corporately, in working to attain some of the important objectives of the profession, I am convinced we would more quickly be able to devise the organization tools needed for effective accomplishment. We already possess reasonably good organization tools, but we too often let them rust for lack of use. Let's use them to the full and by their use learn how to design and forge better ones.

"One further caution, let's not waste time debating our objectives or what we mean by unity. Let's get at the obvious day-to-day problems and let the definitions and the long range plans evolve from experience and a better understanding of our really important problems.

"Let's not deceive ourselves that the answer lies in a more perfect organization and that it will function automatically. Rather let us realize that the job can only be done by individuals, working together in harmony. Let's work harder, especially at the grass roots and thereby lay a better foundation for unity at the national level."

Jim Fairman, a former professor of electrical engineering, a former administrator of the defense power program, and an eminent utility executive, speaks as an elder statesmen in the engineering ranks.

His sound advice applies to those working for unity within the Engineers Joint Council and also to those outside the council who should, for the good of the profession, ally themselves with it.

Eisenhower's Power Budget

The federal budget now before Congress would provide $308.2 million for federal power facilities—lowest amount budgeted in this category for a decade. The bulk of these requests is for projects already underway. However, this budget along with the President's message raises several policy questions of direct interest to electric utilities.

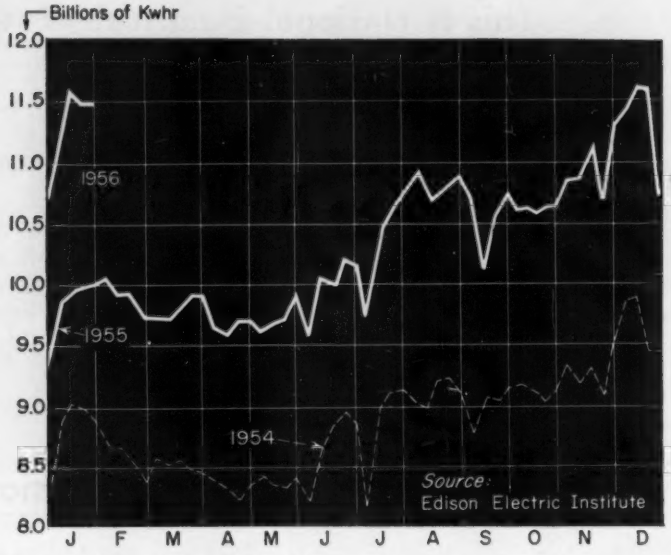
Most controversial of these is a request to allow Tennessee Valley Authority to begin financing its expansion through the use of revenue bonds. The budget indicates that such bonds are needed to provide for the addition of two 135,000-kw units at the new Johnsonville steam plant in 1958, which are needed TVA claims to meet its load growth estimates of that year.

Electric companies last year opposed one form of the revenue bond proposal and are sure to keep a close eye on legislation along these lines this year. There is some opposition also from Democrats in the TVA area who want to provide the funds through regular appropriations. Outcome may depend on how hard the Administration pushes.

Second item of direct interest to utilities relates to partnership development of hydroelectric facilities. The $9.4 million requested for Bureau of Reclamation and Army Corps of Engineers for use in connection with partnership projects would be a start toward implementing this key Administration policy. It amounts to less than 3% of the money asked for federal power spending, but it sets the stage for a broad extension of partnership principle.

There are a number of lesser items in the power budget which merit watching, but these are the key items with which Congress will deal in this field.

ELECTRICAL WEEK



OUTPUT

Week Ended Jan. 28
11,512,000,000 Kwhr
Up 15.1%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 10.5%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Jan. 28	+15.1	+11.0	+8.9	+22.8	+10.2	+13.1	+14.5	+10.2	+17.1	+16.3
Jan. 21	+15.4	+11.2	+9.1	+23.6	+11.2	+16.1	+13.2	+12.6	+14.9	+10.6
Jan. 14	+16.8	+13.3	+11.2	+25.4	+10.6	+18.8	+12.6	+11.7	+15.9	+9.5

Seasonally Adjusted Index 213.5 Week Ago 212.5 Year Ago 185.2

Issue's Highlights—Panel for Joint Congressional Atomic Energy Committee urges greater industry participation in atomic development and declassification of all non-weapons data . . . Rains bring some drought relief to TVA . . . Admiral Ben Moreell scores federal water resources and power policies . . . CIGRE reelects Philip Sporn president; discusses plans for international conference in Paris.

Wall Paper Heating?—Space Heating Ltd, of London, England, is experimenting with a new method of heating rooms—wall paper containing electric elements. Wires are replaced by flat foil conductors bonded onto backing of insulating material produced by a process similar to that of printing.

Co-op Ruling—Utah State Supreme Court has upheld contention of state's PSC that co-ops are not public utilities and therefore have no standing before regulatory bodies. Effect of decision is to permit Utah P&L to extend its transmission lines into San Juan County. Protestants to PSC order favoring UP&L were three Colorado co-ops, San Miguel Power Association, Empire Electric Association, and Colorado-Ute Electric Association. Said court: "Since the plaintiffs cannot legally be required to serve the public generally, they are not public utilities and the PSC correctly so decided."

No Hotpoint Sale—GE has informed EW that it has not been approached and that it is not interested in selling its Hotpoint division. This was in answer to EW's report last week of Wall Street rumors that Ford was looking into possible purchase of Hotpoint.

Labor—Strike of Selco Employees' Association-Ind against Sangamo Electric Co over contract negotiations enters third week with 1½% differential keeping both parties apart. Company is offering 8% wage hike; union seeks 9½% . . . Arbitration panel has decided UWUA is entitled to 3.45% wage increase from Pennsylvania Power Co—this is same percentage offered by company in negotiations preceding strike last year.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—House interior committee approved 14-5 the Chenoweth Bill (HR 412) for federal construction of Fryingpan-Arkansas Project . . . New highway bill (HR 8836) providing for reimbursement for relocation of utilities installations was introduced in House by Rep Fallon (D-Md.). Fallon's measure provides for federal payments to states, whenever states reimburse utilities for their relocations. Hearings on highway legislation begin Feb. 7.

New Appointments—Pennsylvania P&L has advanced Walter B. Morton from assistant to electrical engineer effective Feb. 1. He succeeds Stanley C. Townsend who becomes manager of atomic power . . . Edwin J. Merrell has been appointed chief engineer of Harbirshaw Cable & Wire Division of Phelps Dodge Copper Products Corp. He succeeds William A. Del Mar who becomes consulting engineer for company.

AIEE Winter Meeting—Pres M. D. Hooven told 5,000 attending engineers techniques now known need only be applied to make completely automatic home a reality. He envisioned tomorrow's chore-less living centrally controlled from one small room.

One of engineering's highest awards, the 1955 Thomas A. Edison Medal was awarded Leonid A. Umansky, retired manager of engineering, Industrial Engineering Division, GE . . . Alfred Nobel Prize, offered by ASCE for outstanding technical paper on electrical engineering subject went to R. L. Bright, Westinghouse Electric, for his "Junction Transistors Used as Switches." Bright said 100-amp unit should be available in another year.

James F. Fairman, vice president, Consolidated Edison, was awarded honorary AIEE membership, 43rd bestowed since society's inception in 1884. He urged profession to tackle day-to-day problems and "let definition and long-range plans evolve from experience."

In addition to hearing 500 technical papers and reports, meeting nominated new officers (see below for president). Following vice presidents were nominated: Donald E. Garr, GE; Leland F. Stone, GE; James H. Foote, Commonwealth Associates; Norman F. Rode, Texas A&M College; Mansfield M. Ewell, Westinghouse; and Henry H. Kerr, Toledo Edison. Directors nominated were: William R. Brownlee, Southern Services; Alva A. Johnson, Westinghouse; L. M. Robertson, PS of Colorado; and Walter J. Barrett, New Jersey Bell Telephone, renominated treasurer.

ABOUT PEOPLE IN THE INDUSTRY

Mervin S. Coover, head of Electrical Engineering Department, Iowa State University, has been nominated for 1956-57 presidency of AIEE. Coover received his electrical engineering degree from Rensselaer Polytechnic Institute in 1914. Then he joined Montana Power and remained with them until he joined the army in 1918. Upon discharge from the Army he began his teaching career, first with the University of Colorado, and from 1935 with Iowa State. Vote on nomination will be announced at AIEE Pacific meeting.

U. S. is moving toward solution of the shortage in engineering and scientific manpower, U. S. Steel Chairman Roger M. Blough told AIEE meeting. Among other things, law of supply and demand is operating to increase financial reward to engineers, he noted. Shortage of engineers and scientists should not be regarded as isolated problem, but as "symptomatic of growing shortage of adequate manpower in other fields . . ." It is due to unprecedented growth in our economy rather than Russian technological advances, he added.

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Private Atomic Development Pushed

- **Group headed by McKinney and appointed by Atomic Energy Committee urges greater declassification of atom data**
- **Private insurance for atomic installations recommended and warning sounded against establishment of government plan**
- **Panel's power seminar urges industry assume responsibility for research and reduced government effort with periodic check**
- **Federal subsidies proposed for private construction of one full-scale demonstration plant for every reactor design**

ROBERT MCKINNEY

An outside investigating panel, which had access to secret government reports over the last 10 months, this week kicks off the biggest contest yet over how to develop peaceful uses of the atom.

The nine-man panel, appointed last March to advise the Congressional Joint Atomic Energy Committee, gathered together 750 pages of background material, and wrote a 150-page summary report, highly critical in spots of the existing program.

When the committee on Tuesday convenes its hearings on the Atomic Energy Commission's peacetime program, this mass of evidence will come into play.

Panel Members Named

The panel which prepared the report was headed by Robert McKinney, New Mexico publisher and friend of Sen Clinton P. Anderson (D-N.D.), chairman of the joint committee.

Anderson named to serve with McKinney, Sutherland C. Dows, president and chairman of Iowa Electric Light & Power Co; Samuel B. Morris, general manager and chief engineer of the Los Angeles Department of Water & Power; Frank M. Folsom, president of Radio Corp of America, and five other members from labor, management, and universities.

Here are some of the panel's recommendations to speed the development of nuclear power and other peaceful uses of the atom:

- AEC completely declassify reactor technology.
- AEC be prohibited from imposing secrecy restrictions.
- The Defense Department inherit this function, limited to classification of information of direct concern to military projects.
- Foreign agreements be handled by the state department only.
- Subsidies be granted for private construction of at least one full-scale demonstration plant for every reactor design.
- Lacking industry development of all of these, the government build at least one demonstration power plant of each design.
- The government avoid an atomic hazards insurance program, and encourage, instead, private underwriting.
- Thermonuclear (fusion) data be declassified to aid decisions of prospective investors in fission power plants.
- AEC announce a patent policy and state objectives for its federal research and development program.

Control of Information

The 1954 revision of the basic Atomic Energy Act set forth new ground rules for controls and dissemination of atomic information. AEC has a program to make available to industry and the public those data which Congress ordered reclassified when it ended the government monopoly in the field.

The AEC program was designed to accomplish an orderly transition from a situation in which only government employees and contractors knew the "secrets" of the trade to one in which a large segment of the business community would be acquainted with these facts. It consists primarily of mass declassification of easily identifiable information which has no known military application and classification of two categories available only to those whose background has undergone a security check.

Federal Check Now Required

A brief federal investigation is necessary for a businessman to obtain access to restricted information of indirect relation to the military program, and a full-scale investigation of his personal and business background is demanded before he is eligible to obtain more sensitive information directly related to the weapons effort.

The panel would discard this whole concept on the grounds that it is holding up the speedy development of a commercial U. S. atomic energy industry.

The report recommends discarding the idea that all atomic information is "born" classified. The panel indicates its belief that only information which reveals the inner workings and the status of our weapons program and our knowledge of the weapons programs of other nations should remain restricted. It feels that all reactor

by Panel for Joint Congressional Unit

SUTHERLAND C. DOWS

FRANK M. FOLSOM

SAMUEL B. MORRIS

technology can safely be declassified, retaining under secrecy only facts pertaining to the use of this technology in the making of weapons.

The panel's suggestion may run into heavy opposition at AEC. To go along with the idea would mean, in effect, ending a major AEC function.

But there is a sizeable body of AEC officials in agreement with the panel. And informed representatives of both political parties in Congress have expressed similar viewpoints, including Anderson and former Joint Committee Chairman W. S. Cole (R-N.Y.).

Ownership of Materials

Looking toward the day when special nuclear materials can be turned loose from monopoly government ownership, the panel recommends a continuing review, under law, of the present policy. Its members recognize that the present situation demands government ownership, but they are convinced that private ownership in the long run will prove practical and beneficial.

The panel objects to the control function that ownership of a raw material carries with it. And this natural repugnance toward government monopoly is aggravated by the vital nature of the material involved in this case.

AEC, too, may begin to feel the same way soon. It is becoming enmeshed in a vain struggle to maintain a simple control system since new problems arise as the size of the supply chain grows.

The panel sees as the most critical of these AEC problems the chore of pricing special nuclear materials. The commission, under the 1954 act, is the only purchaser of plutonium and U-233, the special nuclear materials. So AEC has set up a classified price schedule, ostensibly to reimburse industrial plants for producing the materials.

"In most prospective near-term commercial power reactors, the 'buy back' price could make or break the economics of the plant," the panel states. "By law, the Commission can only guarantee 'buy back' prices for seven years, while plants able to produce such material must run for 25 to 40 years to amortize their costs.

"Thus, private investors have no way of forecasting when they may suddenly be thrown into a losing operation as a result of changes in future commission-guaranteed prices. It is true that all licensees receive the same prices, but all licensees will not have the same types of plants and may have differing break-even points."

Advantage of Stable Price

There is an advantage to the relatively few companies in the atomic field in the next few years in having a stable government price offered them during their early years of operation. This is an advantage not enjoyed by firms using other commodities, such as copper, where wide market price fluctuations provide for comparable fluctuations in operating costs.

Nevertheless, the panel feels the time will come for an end to government ownership of special materials when there are an adequate number of producing power plants to utilize commercially produced special materials as reactor fuel. Such a market will have the same inherent stabilization as other commodity exchanges, and it is on this basis that all concerned want the atomic industry to develop.

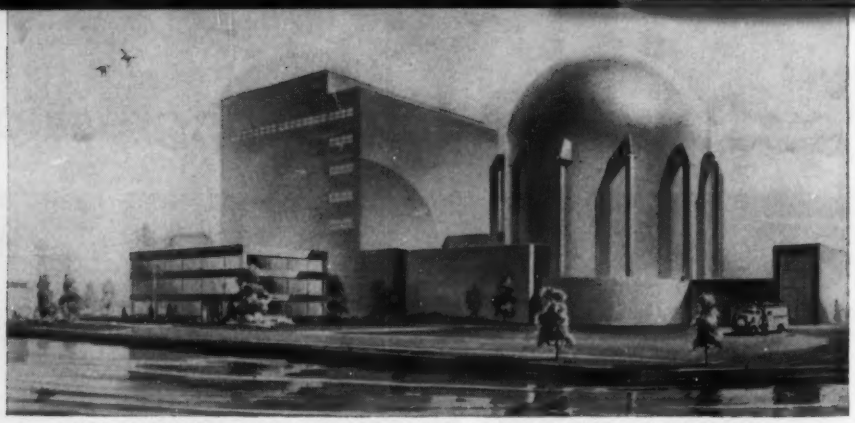
Power Factors Considered

For its information, the panel went to a great number of industry executives, each recognized in his field. It brought these representatives together in seminars. Here's the power line-up.

Roger Coe, discussion leader, vice president, New England Power Co; Harold W. Eaton, manager, Morgan County Rural Electric Membership Corp, Martinsville, Ind.; George M. Gadsby, chairman, Utah Power & Light Co; Wilbur Jurden, chief engineer, Anaconda Co; J. Elmer Housely, Aluminum Co of America; Francis McCune, vice president and general manager, Atomic Products Division, General Electric Co; John Menke, president, Nuclear Development Corp of America; Wallace E. Pratt, geologist; Kenneth A. Spencer, president, Pittsburgh & Midway Coal Mining Co; Eugene Starr, chief engineer, Bonneville Power Administration; Walter Tuohy, president, Chesapeake

(*Continued on page* 65)

W. L. CISLER



ARTIST'S SKETCH OF PRD'S PROPOSED 100,000-KW ATOMIC POWER PLANT

Power Reactor Co Formed

- **To design, construct, operate experimental nuclear reactors**
- **Plan construction of 100,000-kw, $54-million power plant**
- **18 utilities, 8 manufacturers unite; many are APDA members**

R. G. RINCLIFFE

D. E. KARN

H. J. SCHOLZ

E. W. DOEBLER

Eighteen utilities and eight industrial firms have banded together to form Power Reactor Development Co, a Michigan non-profit corporation which will study, develop, design, fabricate, construct, and operate experimental nuclear power reactors.

Initial project of the new company will be construction of a breeder reactor for the atomic power project proposed by Detroit Edison Co and several other firms last March. The Atomic Energy Commission accepted the proposal in August for further negotiation under its Power Demonstration Reactor Program.

Subject to final AEC approval, the 100,000-kw, $54-million power plant will be constructed on Detroit Edison property at Lagoona Beach on Lake Erie, about 30 miles southwest of Detroit.

Close Tie with APDA Planned

Power Reactor Development Co will work closely with Atomic Power Development Associates, a research and development organization formed in 1954. Of the firms comprising the new company, 16 also are members of APDA. At present APDA is working on a reactor test facility for Detroit Edison's Delray Plant.

Aim of Power Reactor Development Co is an "early demonstration of the practical and economical use of nuclear energy for the generation of electric energy, together with such industrial and scientific products and by-products and applications as may seem desirable."

The new company, Detroit Edison spokesmen pointed out, has been organized to consolidate efforts of companies having particular interest in development of the breeder type reactor. Results of its research and development in use of nuclear fuels will be made available to AEC.

President of Power Reactor Development Co is Walker L. Cisler, president of Detroit Edison Co. R. George Rincliffe, president of Philadelphia Electric Co, has been named executive vice president. And vice presidents of the new corporation are Dan E. Karn, president of Consumers Power Co; Herbert J. Scholz, president of Southern Services, Inc; and Errol W. Doebler, president of Long Island Lighting Co.

PRD Member Companies Named

Fourteen power companies and two industrial firms participating in the new venture also are members of APDA.

The utilities are Alabama Power Co, Central Hudson Gas & Electric Corp, Cincinnati Gas & Electric Co, Consumers Power Co, Detroit Edison Co, Georgia Power Co, Gulf Power Co, Long Island Lighting Co, Mississippi Power Co, Philadelphia Electric Co, Potomac Electric Power Co, Rochester Gas & Electric Corp, Toledo Edison Co, and Wisconsin Electric Power Co. The two manufacturing companies are Allis-Chalmers Manufacturing Co and Babcock & Wilcox Co.

Members of Power Reactor Development Co not associated with APDA include four utilities—Columbus & Southern Ohio Electric Co, Delaware Power & Light Co, Iowa-Illinois Gas & Electric Co, and The Southern Co—and six manufacturing firms—Burroughs Corp, Chrysler Corp, Combustion Engineering Corp, Fruehauf Trailer Co, Holley Carburetor Co, and Westinghouse Electric Corp.

Rainfall Eases TVA Drought

. . . but interruptibles remain cut off and Douglas reservoir drained as area experiences the driest winter on record

Recent rains have brought some relief to the drought-ridden Tennessee River Valley where Tennessee Valley Authority has experienced some trouble in meeting demand for its power.

Heaviest rainfall averaging 2.62 in., however occurred along the river's mainstream below Chattanooga. Above the city in the upper tributaries of the river where generation would have benefited most, the rainfall averaged about 0.87 in.

A TVA spokesman told EW that this winter so far has been the driest on record. Until the recent rainfall, the upper basin had only 1.28 in. during January as compared with an average of 5.34 in. for the month.

As a result of the water shortage, TVA has cut off all interruptible deliveries and has drained down the reservoir behind Douglas Dam where there is 120,000-kw of installed capacity.

Douglas Dam is located in the hard-hit upper-basin tributary system. At other tributary dams a total of about 150-million kwhr is being generated each week. This is half of the 300-million kwhr usually generated weekly in the tributary system at this time of year. To manage even the reduced generation, TVA has been drawing down its reservoirs instead of storing which is usually done during the ordinary wet winter season.

After four drought years, all tributary reservoirs are at their lowest level since TVA began its operation 22 years ago.

However, as EW went to press the recent rains were expected to raise the TVA reservoir levels as follows: Norris, 19 ft; Douglas, 9 ft; Boone, 4 ft; Cherokee, 4 ft; Hiwassee, 4 ft; South Holston, 3 ft; Watauga, 3 ft; and Fontana, ½ ft. Although Douglas' expected rise is 9 ft, it would not be sufficient to bring the lake to turbine level, TVA said.

The average annual rainfall for the Tennessee Valley is 51.4 in. Recent below-normal years are as follows: 1952, 44 in.; 1953, 45.9 in.; 1954, 48.1 in.; and 1955, 47.9 in. Effect on hydro generation has been cumulative resulting in the present power shortage.

Delays in delivery of steam units has further complicated TVA's power problem, a spokesman for the authority said. Installation of three units—one for Shawnee Plant and two for Gallatin Plant—has been held up because of the three month strike at Westinghouse Electric Corp where orders were placed, he pointed out.

A spokesman for The Southern Co stated that although water level was low in some of its area, there was nothing unusual or acute about the situation.

CIGRE's U. S. Committee Renames Sporn President

Philip Sporn, president of American Gas & Electric Service Corp, was re-elected president of the U. S. National Committee of the International Conference on Large Electric Systems (CIGRE) at a meeting of the U. S. group last week in New York. Also re-elected were H. L. Melvin, chief consulting engineer, Ebasco Services, as vice president; I. W. Gross, research engineer, AG&E Service Corp, as secretary-treasurer; and Frederic Attwood, vice president, Ohio Brass Co, as honorary president.

CIGRE (Conference Internationale des Grands Reseaux Electriques) will hold its 16th bienniel convention from May 30 to June 9 in Paris, France. The U. S. is represented by approximately 250 members.

Plans for the Paris conference were discussed at the recent meeting when officers were reelected. Eight American papers will be presented at the conference.

Object of the international association, which at present has 2000 permanent members from over 40 countries, is "to discover and diffuse the knowledge of the progress in the technique of large high tension electric systems by bringing into contact . . . the most eminent specialists from each country, and by studying the most recent progress in the field."

At the 1956 convention, 116 papers in French and English will be presented covering such subjects as generators, transformers, circuit breakers, high voltage cables, towers and tower foundations, overhead lines and vibrations, insulators, protection and relaying, system stability-load and frequency control, extra high voltage lines, and DC transmission at extra high voltage.

NEWS BRIEFS

The government won its battle to cut by more than half the award of over a million dollars made by lower federal courts to the Twin City Power Co for land taken to build the multi-purpose Clark Hill Dam on the Savannah River. By a 5-4 margin, the Supreme Court upheld the government's argument that the award must be figured under the compensation formula for flood control projects, rather than the higher scale for power projects used by the lower courts.

Committee to exchange information on atomic fuels for power generation has been formed by Carolina Power & Light Co, Duke Power Co, Virginia Electric Power Co, and South Carolina Electric & Gas Co. The four-man committee, which may also serve in an advisory capacity at a later date, is composed of Raymond Talton, production engineer, CP&L; H. W. Oetinger, executive assistant, Duke; R. M. Hutcheson, system manager-production, VEPCO; and George Dibble, manager of production and transmission, SCE&G.

Appalachian Electric Power Co, operating subsidiary of American Gas & Electric Co, plans construction of a 450,000-kw, $55-million generating plant at Carbo, Va., on a 105-acre site to be purchased from Clinchfield Coal Corp. Adjacent Clinchfield coal mines will supply fuel for the two 22,500-kw generating units. The station, to be owned and operated by Appalachian, will be integrated with systems of Kentucky Power Co and Kingsport, Tenn., Utilities, Inc.

Moreell Scores Federal Policy

. . . on water resources at Engineers Joint Council meeting; Hoover task force head claims government power unnecessary

Huge losses in federal revenues resulting from below-cost power sales and the permanent commitment of precious water to uneconomic and wasteful uses have been listed by Admiral Ben Moreell as among the bad results of current "hodge-podge" federal water resource policies.

As chairman of the Task Force on Water Resources and Power of the Second Hoover Commission, Admiral Moreell aired his views at the recent general assembly of the Engineers Joint Council in New York City.

Admiral Moreell, who is chairman of the board of Jones & Laughlin Steel Corp, said:

"Grew Like Topsy"

"I believe the most important conclusion of the Task Force is that the activities of the federal government in this vital and costly field have grown like Topsy, with no central supervision except a 'once-over-lightly' by the Bureau of the Budget. Huge sums have been spent without benefit of any clearcut, unified body of federal policy. . . . The current policies, taken together, are a hodge-podge of contradictions which generate conflicts among agencies."

Admiral Moreell's address dealt in considerable part with the problem of federal power. This is important, he told his audience, for two reasons. "First, because the so-called 'liberal' groups have found that this issue has a strong popular appeal which can be used as a powerful political vehicle; secondly, because socialized power can easily lead to socialized industry."

Calls Federal Activities Needless

"Technically and financially," he continued, "there is no present or prospective need for federal power activities. There is no lack of ability on the part of private power to finance and install needed generating, transmission, and distribution facilities."

"The government is busy actively promoting the killing of the geese that lay the golden eggs," Dr S. C. Hollister, a member of the Hoover Commission and Dean of the Cornell School of Engineering said in analyzing the Hoover Commission Reports.

Commenting upon the "more than 3,000 businesses and industries" in which the executive branch of the government is engaged in direct competition with private industry, Dean Hollister said, "Competition of this type between government agencies and private enterprise is made increasingly unfair because of the increased income taxes now being imposed on corporations and private individuals."

Walker L. Cisler, president of Detroit Edison Co, in an evaluation of the electric power aspects of atomic energy, said that estimates of world energy resources show the need to double electric and other forms of power output by 1975 and to redouble it by 2000.

Cites Atom Fuel Use Importance

Use of atomic fuel has particular importance because it can be transported so easily to fuel-poor and underdeveloped areas of the world, Cisler said. He expressed confidence that atomic energy ultimately would bring about industrialization and better living for people in underdeveloped areas of Africa, Latin-America, and elsewhere.

Cisler emphasized that a number of limiting factors in atomic energy development must be considered. He defined these as:

1. Availability of essential nuclear materials.

2. Technical developments in the utilization of nuclear energy.

3. Economic considerations of nuclear energy as compared with conventional energy sources.

4. The nature of the prevailing local economy and its adaptability to the use of electric power.

5. The ability to finance the required investment in electric power supply undertakings.

In a talk on "The Role of the Office of Defense Mobilization" in the development and utilization of specialized manpower including scientists and engineers, Brigadier General Carlton S. Dargusch, assistant director of ODM for manpower, outlined programs underway in ODM to fulfill its responsibilities in this field.

These plans include the assessment of post-attack requirements for scientists and engineers. "At the present time," said General Dargusch, "we are developing the specific dimensions of this problem and working out definite plans through which we can get some idea in advance of just what our requirements would be for scientists and engineers and how we might most effectively go about mobilizing those required."

"If we are to maintain our technological superiority, we must," he said, "accord to the profession of teaching and to science and engineering appropriate recognition."

Honors and Awards Urged

To this end, General Dargusch seconded the suggestion of Director Arthur Flemming, of the ODM, that American enterprise, including the professional societies, such as Engineers Joint Council and the foundations, establish immediately a fund of not less than one million dollars annually to provide for honors and awards to a substantial number of individuals each year, who have distinguished themselves in studies or in contributions to science and engineering which have benefited the nation in some respect.

National Safety Council Publishes Revised Manual

A new enlarged edition of the Accident Prevention Manual for Industrial Operations has been published by the National Safety Council, with numerous sections covering specific types of hazards found in industrial operations, their prevention and control.

This 1341-page, 3rd edition of the manual, which includes information necessary to setting up a comprehensive safety program, contains 43 sections, 17 of which are completely new.

Written by council engineers and safety specialists from industry and government, the manual includes information on setting up safety committees, maintaining interest in accident prevention activities, and developing favorable publicity and public relations.

The manual, priced at $13.50, may be purchased from National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Panel Pushes Private Atom

(*Continued from page* 61)

& Ohio Railroad; C. C. Whelchel, chief engineer, Pacific Gas & Electric Co; Charles F. MacGowan, international representative, International Brotherhood of Boilermakers.

Present as advisers were Robert Charpie, assistant director, Oak Ridge National Laboratory, and Titus LeClair, vice president, Commonwealth Edison Co of Chicago.

This group found, as some utilities already had, that atomic power plants essentially have few differences from conventional generating stations. But they did make some observations on points which should clear the air:

- Since, in general, cost of power is not the major factor in locating industrial plants, the coming of nuclear power will not result in significant changes in load growth patterns.
- With the high degree of interconnection characterizing electric utility systems in most sections of the country, no specialized role is seen for nuclear power, except in isolated locations. Also because of the excellent interconnection pattern, small nuclear stations probably will prove uncompetitive with larger units if it is at all possible to tap these larger units for distribution to the areas in question.
- Nuclear power will have no disruptive effect on continued use of conventional fuel, and, in fact, growing power demands will require sizable increases, not decreases, in production of coal, oil, and natural gas.

Technical Feasibility Value

- The seminar felt that an immediate finding of "practical value" based on technical feasibility, rather than economic considerations, as now required by law, would have a "most desirable effect" on growth of nuclear power. The importance of a Commission finding of "practical value" lies in the fact that such a finding is necessary before AEC can issue a commercial license to a company. Unless this is done—and it has not occurred to date—only "experimental" licenses are permitted.
- The seminar, largely made up of utilities officials, is recommending immediate initiation of a device which could eliminate a large bloc of government aid, since only experimentally licensed plants are eligible for government subsidies. It is also interesting to note their insistence that this be done by law, authorizing the initiation of proceedings leading up to such a determination to reside with the company, rather than only with the Commission, as the law now provides.
- The power seminar urged that industry assume the major responsibility in research, and a correspondence tapering off of government effort. To get this started, members recommend establishing a trend of reduced government effort, and periodic reexamination of the question.

Power Growth and Costs

The power seminar called together a special study group—representatives of AEC, utilities, and electric equipment manufacturers—to forecast nuclear capacity growth and costs. These experts came up with three separate sets of predictions: Optimistic, pessimistic, and present. The first left out many adverse factors which could stunt the growth of the new industry, the second limited itself to fewer outside factors which could stimulate its growth, and the third adhered to a combination of these factors—a move which prevents "present" curve line from being true average of the others.

The study group couched its predictions as a percent of total thermal installations that would be nuclear powered in a given year. The optimistic view resulted in predictions that ranged from 30% in 1970 to 93% in 1980. The pessimistic view held that nuclear additions in 1980 would be only 38% of thermal added that year. The present view forecast 14% in 1970, 45% in 1975, and 65% in 1980.

Fuel Costs Predicted

To come to these conclusions, varied as they are, the study group had to investigate load factor patterns and consider fuel costs. Briefly, they found that, because nuclear plants are expected to have lower production cost than conventional thermal plants, they should operate at somewhat higher load factors during their middle years.

On fuel costs, the study group estimated a pessimistic curve running from 4 mills per kwhr to 1.5 mills in 20 years. Its optimistic prediction was from 3 mills to 1 in that time. The consensus of the conferees was that nuclear fuel cost would probably reach 2 mills by 1965, decreasing to 1.5 by 1980. These figures compare with the lowest current conventional fuel costs in high performance plants of about 3.3 mills in New York, 2.7 in Chicago, and 1 in Dallas.

The study group concluded with this statement:

"There are so many different technical avenues available it is inconceivable that technical obstacles can do more than alter the path, reduce the rate of rise, or cause a moderate delay. From the variety of attacks already mounted, a real setback due to new technical problems arising is most unlikely.

"There remains a vast amount of technical work to be done—costly in both technical men and money—to bring atomic power into competition in continental United States. But, the incentive shown by this forecast is both clear and forceful. There is a genuine market. It is large and not too far ahead."

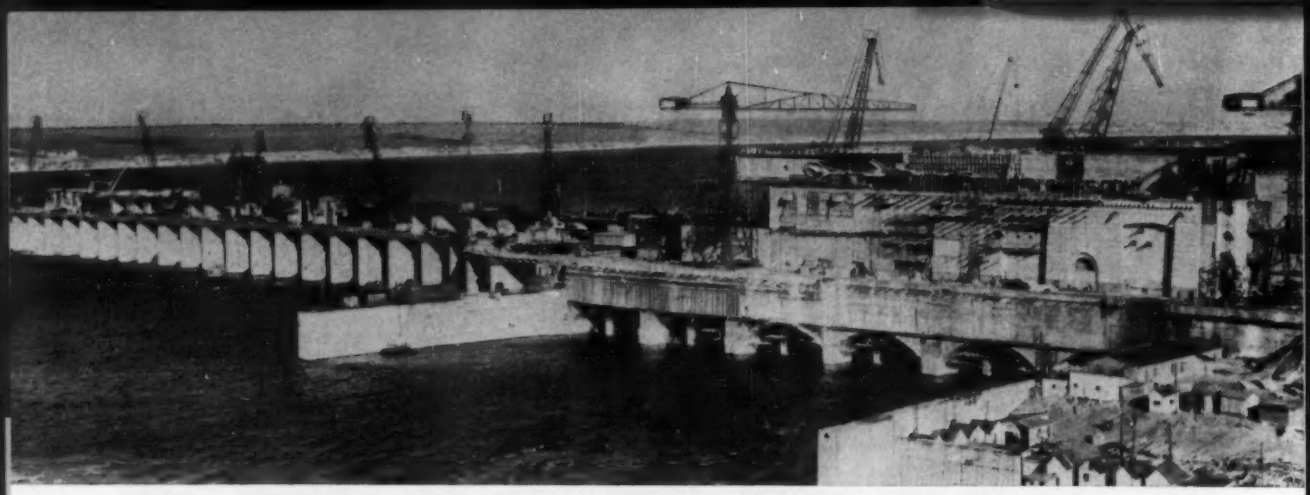
Insurance Plans for Private Atom

Atomic law now holds the government blameless for damages as a result of licensed peaceful uses of atomic energy. So that licensee must assume full responsibility, for to date the insurance industry has not offered to underwrite the risks involved. A study is now being made of this.

The panel recognized the insurance industry's problem—a lack of the necessary data concerning hazards and needed coverage on which to base a determination of whether or not industry can underwrite the risk. It urged the Commission to set up its efforts to make such data available during the two or three years remaining before the first big atom plants go into operation.

Meanwhile, the panel warned against hasty establishment of any government insurance plan. It found itself unconvinced that the Reactor Development Program was of such magnitude that it warrants large-scale insurance.

"It seems to us," the panel says, "to be much too early for private enterprise to concede defeat on the insurance problem. To do so is to prejudge the research efforts still underway and to jeopardize unnecessarily the national attempt to carry atomic power forward to widespread application by private enterprise."



Despite ballyhoo about plants like Kuibyshev and Kakhovka (above) . . .

Soviet Power Production Is Lagging

- ★ Former Soviet official sees lack of power hampering industry
- ★ Estimate places 1960 output at less than half U. S. '55 figure
- ★ Industry also handicapped by poorly trained technicians
- ★ Soviet trend to larger installations and larger units noted

When the Russian Communist Party holds its twentieth congress this month, it is going to have to take a hard look at Soviet power production. Best available information indicates that lagging power production continues to be a major bottleneck in the Soviet economy.

A comprehensive analysis of the Soviet electric power situation was recently made in the Bulletin of the Institute for the Study of the USSR, an organization of anti-communist emigre scholars from the Soviet Union. The institute, located in Munich, receives technical and material support from the American Committee for Liberation from Bolshevism, Inc. The author of the article, G. A. Vvedensky, is an expert on Soviet industry having been a former Soviet official himself.

According to Vvedensky, the Soviet power picture shows poor coordination and mistakes in planning, and an insufficiency of power in the places where it is most needed. He notes that during the fall of 1955, "this shortage, presenting such a threat to industry and transport, was most evident in European Russia, especially the Urals.

"The insufficiency of electric power was the result of the disproportionate development of the various economic regions. Because of postwar mistakes in planning and the distribution of power supplies, more than three quarters of all Soviet industry has been concentrated in the European regions, but only half of the fuel and power industries are located there."

A Crisis in Urals Exists

Although the prospects for early improvement exist, the position of industry in the Urals is not encouraging, he states, because of deficiencies of fuel and electric power.

The crisis in the Urals has come about in spite of the impetus World War II brought to power construction in the area. During the war, the European regions lost 5 million kw of capacity through destruction plus thousands of miles of transmission.

From 1947 to 1950, stations damaged or destroyed during the war were restored, and the overall capacity considerably exceeded the prewar total. Thus, in spite of the war, between 1940 and 1950 Soviet electric power stations increased their output from 48.3 billion kwhr to 90.3 billion. From 1951 to 1955 the annual output increase varied between 10 and 18.8 billion kwhr (see table).

For these five years (Fifth Five-Year Plan) the increase in electric power output should total almost 76 billion kwhr. But the position is likely to remain critical. Thus Soviet leaders can be expected to set higher annual targets for the Sixth Five-Year Plan than has been achieved in the past five years.

Vvedensky points out that assuming an annual increase equal to that of 1955, the targets in billions of kwhrs would be: 1956—184, 1957—202, 1958—220, 1959—238, 1960—256. Even so, the USSR will lag far behind the United States with its 546.8 billion kwhr production in 1955.

The growth in capacity in 1954 was 30% over that of the previous year. Nevertheless, the Minister of Electric Power Station Construction, F. Loginov, admitted that the rate of introduction of new capacity was unable to meet the needs of the economy.

The following is a list of major new plants that had been scheduled to begin operation during the 1951-55 period; and, as nearly as can be determined, how they fared:

Stations	Ultimate Capac.	Capac. 12/31/55
	(Thousands of kw)	
Hydro		
Tsimlyanskaya	164	164
Gyumush	224	224
Verkhne-Svirskaya	160	160
Mingechaur	357	357
Kama	500	320
Ust-Kamenogorsk	160	160
Kakhovka	260	150
Kuibyshev	2,100	*
Gorky	400	100
Narva	Not Available	
Knyazheguba	Not Available	
Zakarpatskaya	Not Available	
Dubossary	Not Available	
Belorechka	Not Available	
Ezminskaya	Not Available	
Thermal		
Mironovskaya	400	400
Slavyansk	200	200
Yuzhno-Kuzbasskaya	400	400
Cherepet	600	300
Riga	Not Available	
Shchekino	Not Available	
Pridneprovskaya	Not Available	
Darnitsa	Not Available	
Barnaul No. 2	Not Available	
Saratov No. 2	Not Available	

* One or two 105,000-kw units had been scheduled for operation by Dec. 31, but according to Pravda of Oct. 14, 1955, the first units will not operate before February 1956 (Recent press reports said first unit went on line Jan. 9).

★ SOVIET POWER GENERATING CAPACITY AND PRODUCTION

	Output Actual	(Kwhr in billions) Increase	Capacity (Millions of kw)		Output Actual	(Kwhr in billions) Increase	Capacity (Millions of kw)
1913	2.0	—	1.1	1950			
1916	2.6	0.6	—	(Plan)	82.0	—	22.4
1921	0.5	—	0.00	1950			
1925	2.9	2.4	1.4	(Actual)	90.3	42.0	—
1928	5.0	2.1	1.9	1951	104.2	13.9	—
1929	6.2	1.2	2.3	1952	123.0	18.8	—
1930	8.4	2.2	2.9	1953	133.0	10.0	24.8
1931	10.7	2.3	4.0	1954	147.6	14.6	25.8
1932	13.4	2.7	4.6	1955			
1933	16.4	3.0	5.4	(Plan)	165.0	—	26.4
1934	20.5	4.1	—	1955 (Bulganin's			
1937	36.0	15.9	8.1	Figures)	166.0	18.4	—
1940	48.3	11.9	11.0	1960	—	—	28.0*

*European Russia

Vvedensky also makes these observations regarding big projects that are scheduled to go into operation during 1956-1960:

Kuibyshev—This plant is to have twenty 105,000-kw units. The first unit is now reported to have started but when the remaining units will start cannot be determined. U. S. estimates place construction about two years behind schedule.

Stalingrad—This plant was to be in full operation by the end of 1956. But because of alterations and a late start this schedule will not be met. Capacity of this plant has been increased to 2,310,000 kw from originally scheduled 1,700,000 kw. Full operation now is not expected to be achieved until 1957-58.

Angara—Reports indicate that construction is proceeding at an extremely slow rate on this 660,000-kw project. In this respect the situation is similar to two other major power stations in Siberia—the Novosibirsk and the Bukhtarma. They are not expected to be in operation before 1957.

Votkinsk—Construction is scheduled to begin in the spring. By the end of the Sixth Five-Year Plan this station is expected to play a major role in the Southern Urals and the Tatar SSR.

In 1955 more than 700 electric power stations were being constructed or enlarged, Vvedensky states. On their completion the total capacity of all Soviet plants will be increased by 75%. At the same time 449 rural plants with a total capacity of 150,000 kw are under construction.

Great emphasis has been placed on rural plants, Vvedensky notes. In 1928 there were 649 plants with a total capacity of 29,600 kw. By 1954 the capacity had reached 1.5 million kw and if plans for 1955 were fulfilled, total would be 1.7 million kw.

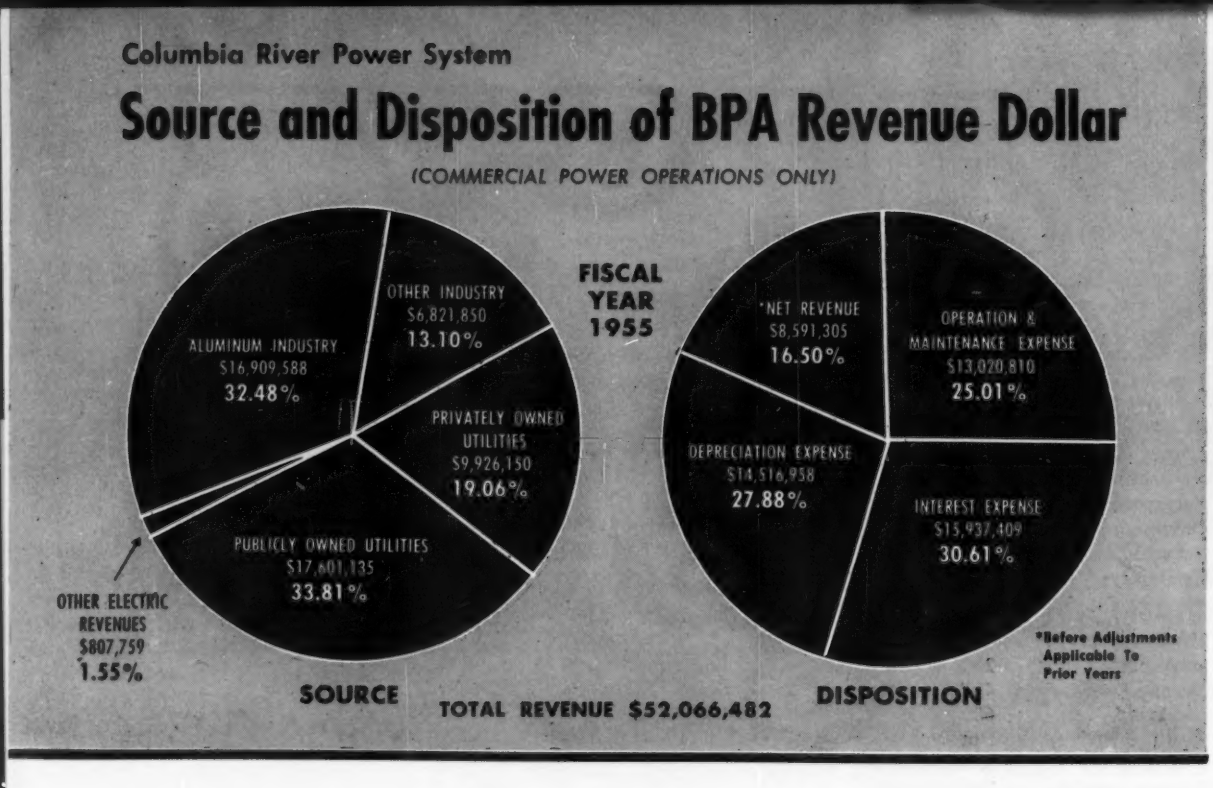
Another development in Soviet power generation is the trend toward larger units such as in the Kuibyshev and Stalingrad stations. And the Soviets claim to have developed larger water turbines than 105,000-kw units in these two plants. At thermal station main emphasis is on 100,000-kw units working at 1,450 psi and 500C. At the Cherepet plant 150,000-kw thermal units working at 2,500 psi and 550C have been introduced.

The future planning of electric power station construction is aimed at maximum utilization of water power. According to Vvedensky, a calculation of the potential of the country's 1,500 primary rivers gives a figure of 300 million kw.

Apparently even in the Soviet Utopia, keeping costs under control is a problem. According to Vvedensky, during the building of the Yuzhno-Kuzbass plant, the rise in prices amounted to 21% from 1945 to 1953. And this was "largely accounted for by an increase in overhead, particularly administration."

Shortcomings in operation are even more noticeable, the Russian notes. "A large number of accidents and stoppages are caused by misused or faulty equipment. Even more are caused by insufficient training of personnel." In 1953 56% of all accidents were attributable to the staff. "Technical training on the whole is not in keeping with the standards demanded by advanced techniques. In addition, many transformers are put out of action by continuous overloading."

Vvedensky concludes: "In spite of an increase in the absolute figures for the capacity and output of power plants, the difficulties in providing many regions with adequate electrical power shows that this branch of the national economy continues to be a bottleneck."


Columbia River Power System
Source and Disposition of BPA Revenue Dollar
(COMMERCIAL POWER OPERATIONS ONLY)
FISCAL YEAR 1955
ALUMINUM INDUSTRY $16,909,588 32.48%
OTHER INDUSTRY $6,821,850 13.10%
PRIVATELY OWNED UTILITIES $9,926,150 19.06%
PUBLICLY OWNED UTILITIES $17,601,135 33.81%
OTHER ELECTRIC REVENUES $807,759 1.55%
SOURCE
*NET REVENUE $8,591,305 16.50%
OPERATION & MAINTENANCE EXPENSE $13,020,810 25.01%
DEPRECIATION EXPENSE $14,516,958 27.88%
INTEREST EXPENSE $15,937,409 30.61%
DISPOSITION
*Before Adjustments Applicable To Prior Years
TOTAL REVENUE $52,066,482

BPA Rate Simplification Suggested

MANAGEMENT
Finance and Regulation

Ford, Bacon & Davis study sees overemphasis on demand charge; finds up to $1.2 million-a-year cuts possible in some rates

Bonneville Power Administration's rate schedules and structures have, in many cases, become complex and cumbersome over the past 17 years. With a view toward simplifying, correcting inequities, and bringing the rate structure in line with current business practice and changing conditions in the utility field, BPA arranged for a special study to be made of its rates.

The study of BPA rates was carried out by Ford, Bacon & Davis, Inc, an independent firm of consulting engineers.

Key conclusions of the detailed study are that BPA rates "reflect an undesirable emphasis" on demand as apart from emergency, but revenues indicate no need for a boost in the $17.50 per kwyr base to meet payout requirements through 1963. In fact, some charges could be reduced, saving customers an estimated $800,000 to $1.2 million in each of the seven years, principally by cutting the secondary, dump, and interruptible energy from 2.5 mills to 2 mills per kwhr, according to the analysis.

The study notes that BPA's so-called "postage stamp" principle of uniform rate application to similar service anywhere in its territory is "so deeply imbedded in BPA's existing rate structure that it would be undesirable to attempt a significant departure from the principle in revising the present rate structure."

Firm power sold "at site" rate of $14.50 per kwyr is a departure from postage-stamp principle and is "illogical" in light of U. S. development of hydrogeneration for regional supply. The analysis, therefore, recommends withdrawal of the rate for future customers, but freezing of existing service to Anaconda Aluminum near Hungry Horse Dam, Mont., and the service contracted for by Harvey Aluminum for its new smelter near The Dalles, Ore., Dam.

The analysis points out that project location (Bonneville, Grand Coulee, as examples) has not been economically suited for industrial location in the 17 year life of BPA until Anaconda took service "at site" by building its own substation tie with Hungry Horse transmission and under the unique Montana power allocation guarantee. Harvey will take the service under agreement to pay for a $12-million transmission line.

It is recommended that the rates for railroad service and for customers tied to computed demand billing (rates R and F) be eliminated. Rate E, the analysis recommends, should be made available to ultimate users without distinction, dropping its limitation of availability to customers of firm power for resale to those who buy at least 90% of their power from BPA.

FB&D suggests eliminating from the E rate the discount of 0.4 mills per kwhr for irrigation pumping and its application frozen to present customers if they oppose withdrawal. Also suggested for elimination from this rate is the 3.5 mills per kwhr ceiling for newly developing systems, and freezing it to existing customers who

oppose withdrawal.

Many of the foregoing involve simplification and widening the low rate available, and thereby the flexibility of customer system operations, to more customers. Elimination of the 90% dependability clause would be welcomed by generating customers.

BPA Superintendent Ray Boals said "we've always felt that clause is unfair, because it discourages a utility to produce its own power."

FB&D recommended that BPA "correct the highly inequitable situation whereunder the cost of operation of the steam-electric plants of the public generating agencies is passed on to two other groups of BPA customers —the industrial interruptible customers at the present time, the privately owned utility companies a few years from now.

"The public preference, as the engineers (FB&D) understand it, is a preference to priority of supply, not a preference as to price. In consequence this discriminatory arrangement should be abolished and arrangements made whereby the preference customers with steam-electric generation may exercise their priorities to purchase dump energy for steam replacement purposes when and if BPA has it available."

The situation, as it applies to private firms, won't occur for perhaps five years as BPA expects to supply all firm needs of the investor-owned utilities in the next several years. FB&D found public preference agencies profit considerably by being able, in effect, to use their standby plants to generate and sell to the Intercompany Pool while BPA supplies the agency's needs at lower dump energy prices.

Rate Uniformity Suggested

Another recommendation in the analysis dealt with the H rate for interruptible, dump, and exchange energy. FB&D suggested this rate be reduced from 2.5 to 2 mills. The report says "a substantial amount of the excess over and above payout requirements . . . is attributable" to this energy. While the engineers recognize "dump energy for steam replacement purposes is worth more than 2.5 mills per kwhr," they believe all this class of energy should be sold uniformly.

This one-fifth reduction in price for non-firm energy would help larger utilities considerably, particularly private companies which in fiscal 1955 purchased 934 million kwhr at $2.2 million while the Seattle and Tacoma city systems purchased 156 million kwhr at $391,000.

BPA reports, however, that in the next five years the amounts sold under this rate will be small because it expects to have enough firm power to take care of the utilities' demands.

FB&D consider the "kilowatt year" rate suited for high load factor industrial customers and favor its continuance but do not consider it "even moderately well adapted" to serving generating customers. But because of the complexity of BPA contracts, FB&D recommended individual customer contractural framework be continued, with deletion of computed demand feature and control of resale rate provisions.

With respect to large industrial customers, FB&D recommend that formal contracts be negotiated for interruptible energy as available. Such contracts could:

1. Specify maximum energy customer would agree to take.

2. Stipulate customer shall take as much of maximum as BPA can deliver under prevailing hydro conditions.

3. Customers should not contract with other suppliers for additional blocks of interruptible except to extent BPA is unable to supply the commitment.

FB&D recommended exchange agreements with non-federal generating customers having hydro storage whereby BPA would supply dump energy in months outside storage season so customers could fill and hold their reservoirs. This could be extended into storage season, FB&D believed, to advantage. Exchange account net balance of kwhr would be billed at 1 mill per kwhr for energy taken in months outside storage drawdown, perhaps 1.5 mills if supplied during the drawdown season.

How to Ease Steam Cost

BPA should institute exchange with generating and industrial customers to permit averaging, over a five-year span, excess cost of steam-generated energy in critical hydro years over the average cost in years of median month streamflow. The five-year period would move forward annually, carrying balance of preceeding year.

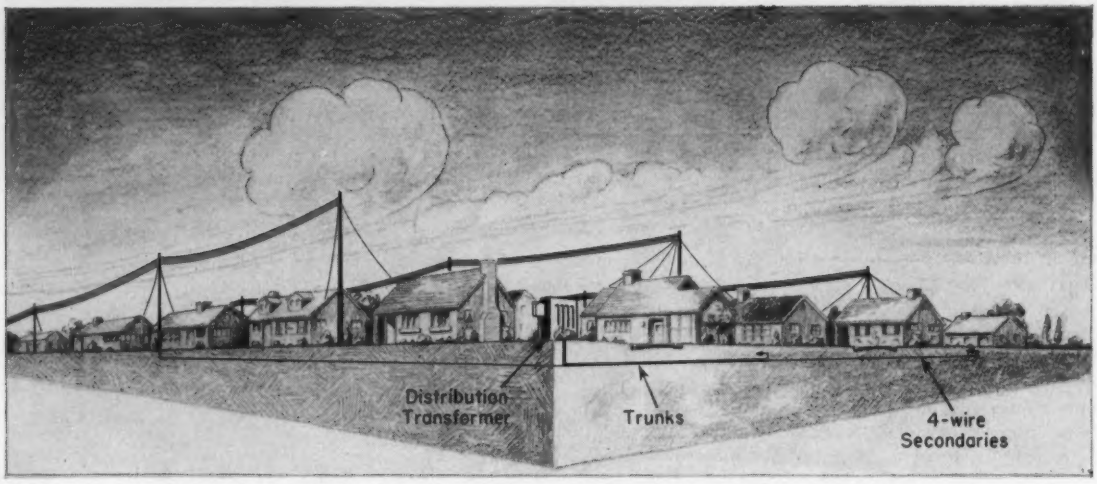
This would reduce the impact of high steam-kw costs which were levied upon consumers of investor-owned utilities in the low hydro winter of 1952-53. These costs ran into millions of dollars.

Such an agreement, FB&D notes, "should be helpful not only in smoothing out the operating expenses of such customers, but would be even more helpful in offsetting the impact of any future federal income tax such as the late so-called 'excess profits' tax whose effect on the higher net income in years of good streamflow would not be offset by the taxes on the lower net income during critical years. BPA could easily serve as a vehicle for leveling out the yearly charge and any attendant income tax effect as BPA is not subject to either federal or state income taxes."

Percent of Power Needs of Northwest Power Pool Members Supplied by BPA

FISCAL YEAR 1955

	Percent of Total Energy Requirements Supplied by BPA
Portland General Electric Co.	61.7
Pacific Power & Light Co.	55.5
Tacoma City Light	52.7
Seattle City Light	21.4
Montana Power Co.	13.7
Washington Water Power Co.	11.1
Puget Sound Power & Light Co.	10.0
Idaho Power Co.	0.4



CUTAWAY SHOWS 265/460-V DISTRIBUTION IN RESIDENTIAL AREA SERVED BY CABLE CONNECTED UNIT SUBSTATION

Higher Service Voltage Cuts Cost

DISTRIBUTION
Design

Three-phase 265/460-v system gives 265-v 1 phase or 460-v 3 phase for major loads. Autotransformer serves 120-v lights

R. F. LAWRENCE, H. E. LOKAY, and R. A. ZIMMERMAN, Electric Utility Engineers, Westinghouse Electric Corp, East Pittsburgh, Pa.

Savings up to 30% can be realized in residential distribution by use of 3-phase, 265/460-v secondary distribution. Extensive studies bear this out. Future residential loads make it imperative that the industry study use of higher secondary voltage to supply new residential areas.

Use of higher secondary voltage permits a system design such as illustrated in Fig 1. The area shown is the total served by one transformer and a small part of the area served by the system. An assumed subtransmission voltage of 34.5 kv supplies the 3-phase transformers in the area. Transformers with ratings up to 2,000 kva serve several hundred homes over a nominal 265/460-v, 3-phase, 4-wire, secondary. Both 265 v and 120 v to ground are made available at each house by a 2-wire service which incorporates a utility owned autotransformer.

Economic studies demonstrate that this system shows substantial savings when compared with the most economical conventional 120/240-v, single-phase distribution system. System investment in dollars per house is compared in Fig 2 for these systems over a range of load densities. The load density is identified in terms of average peak diversified kva demand per house for a group of 1,000 or more houses.

Three-phase at the higher secondary voltage shows the best economy over the range of load densities assumed. For 1.6 to 3.8 kva per house, the most economical conventional single-phase, 120/240-v system steps down from 34.5 to 4 kv. Above 3.8 kva per house it is more economical to utilize the 34.5-kv subtransmission to supply directly distribution transformers serving 120/240-v secondaries.

Higher secondary voltage can go a long way toward alleviating the real problems that utilities face in residential distribution. For example, handling the high demands which occur

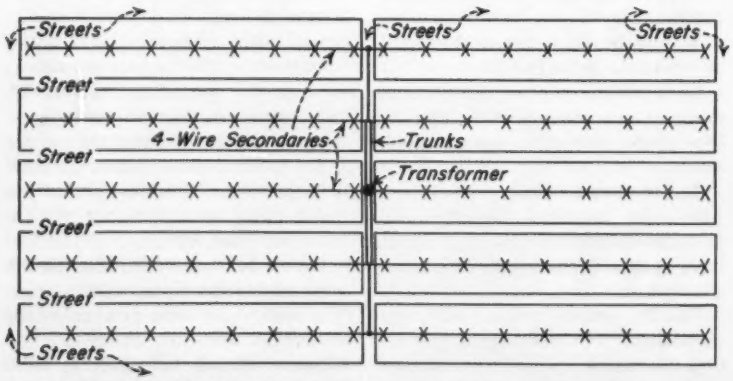


FIG 1—AREA REACH OF 265/460-V serves ten typical blocks from 34.5-kv unit on side street. Multiple circuit feed rear-lot pole lines in each block of the district

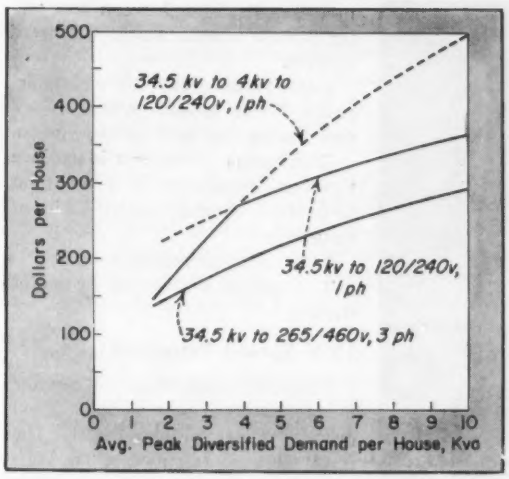


FIG 2—INVESTMENT IN HIGHER-VOLTAGE system is less than in 120/240 for heavy home usage, despite buried trunks

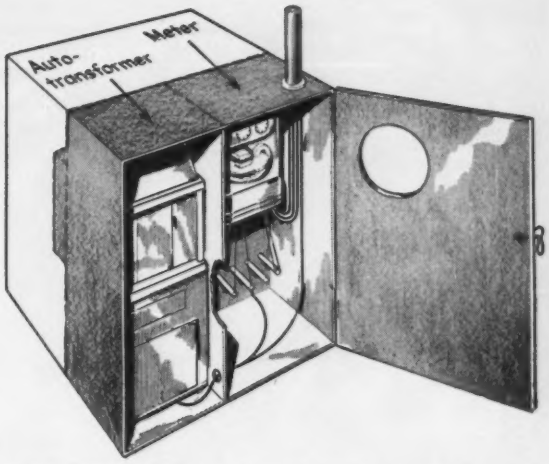


FIG 3—SERVICE UNIT encloses meter and autotransformer in outer part and extends through house wall to service switch

# of Serving Heavier Home Usage

at random in a relatively light-load-density area is of utmost importance. Solution to this problem is of necessity achieved today on a piecemeal basis. Small distribution transformers and associated lineal secondaries on the conventional system are fragmentary increments of the system as a whole.

Transformers Need Policing

A few high peak demands can adversely affect the economical transformer-secondary combinations. The cost to provide adequate service to these high peak demands, which often have a poor load factor, may be excessive, and best economy must be sought in careful engineering of the component parts. Careful policing of transformer loadings is a necessity, too. Otherwise wasteful distribution capacity may be installed or too frequent change-out of distribution transformers and cutting of secondaries may result. Increased use of room air conditioners and the problems they pose offer cogent evidence of these complications.

The 265/460-v system can handle random high demands as they occur, without modification or additional investment. The reason is that the demand of a few random loads on the secondaries of large 265/460-v transformers represent a very small percentage increase in transformer load. Use of a higher-secondary-voltage system would put the supply of small or large home demands in the same class as the problem of supplying both small and large distribution transformers from substations.

Higher-secondary-voltage systems will also provide more economical service for high load densities. Higher voltage makes it possible to serve a larger area with one large transformer, thereby eliminating many of the complexities of the conventional 120/240-v system.

Compatible Secondary Needed

Substantial reduction in system investment indicated in economic studies of higher secondary voltage paves the way for handling the heavy residential loads of the future. It is hoped that these studies will promote consideration and further detailed analysis of the problem. Joint action by utilities and electrical equipment and appliance manufacturers is necessary to select a compatible higher secondary voltage.

Installed equipment costs were used in all economic comparisons. Costs include substations, primary feeders, conductors, poles, hardware, distribution transformers, secondaries, and services. Subtransmission circuits were assumed to be available. Meter costs were not included.

The primary and secondary systems were analyzed simultaneously to obtain lowest overall system cost for each combination of voltages. This is necessary to insure a thorough economic comparison.

The costs are based on supplying the given values of load density in a new area with new distribution construction. Thus each of these load densities is a design criterion for determination of new facilities required to serve the particular load density. Costs for this study do not include such utility overhead items as engineering, insurance, taxes, depreciation, maintenance, and losses. Utilities making cost comparisons should include such costs as determined by local situations.

Larger Transformers Practical

The 265/460-v, 3-phase, 4-wire system is illustrated in Fig 1. (See also "Higher Service Voltage Can Solve Residential Distribution Problems," EW, June 13, 1955, p 82). At higher voltages the secondary distribution pattern changes from lineal to area coverage. It is possible for secondary circuits to emanate in four directions from each distribution transformer. A larger area encompasses more load, thus making possible the use of large distribution transformers which can be supplied economically by 34.5-kv sub-transmission.

Three-phase distribution transformers supply 3-phase, 4-wire secondary

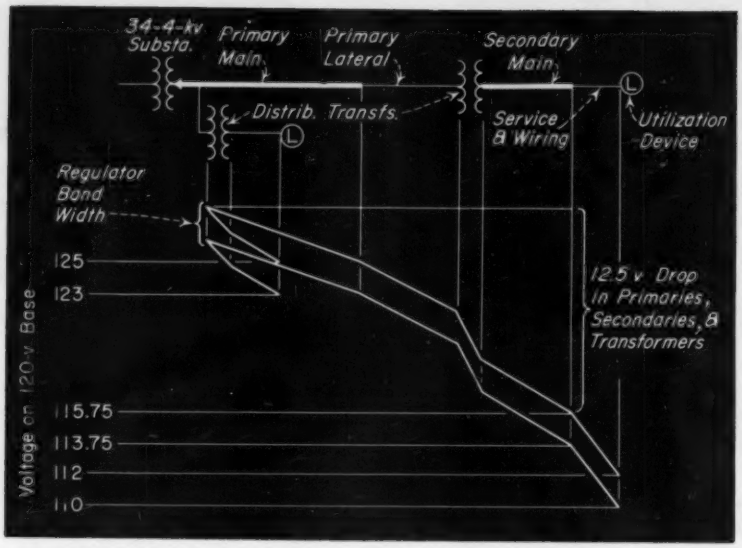


FIG 4—VOLTAGE PROFILE OF CONVENTIONAL DISTRIBUTION limits primary, secondary, and transformer drop to 12.5 v to provide "favorable" voltage to devices

trunks. These trunks are generally multiple-conductor circuits which supply 3-phase, 4-wire secondaries along back-lot lines in each block.

Basic service to each house consists of a grounded neutral and one phase conductor and provides nominal 265 v to ground. The major fixed appliances—range, clothes dryer, and water heater—are served at 265 v. Room air conditioners, which require heavy reinforcement on conventional 120/240-v distribution systems, should also be served at 265 v. The service equipment includes a utility owned autotransformer, nominally of 1-kva rating, to provide 120 v to ground for lighting and convenience outlet circuits. Meter, autotransformer, and service entrance equipment might be enclosed in a service unit, Fig 3.

Three-phase, 460-v service is available to any house in the area. Central air conditioning, heat pumps, or large motor applications that can best utilize 3-phase motors would be served 3-phase.

Conventional 120/240-v, single-phase, 3-wire secondary systems are well known and need no description.

Distribution system cost is sensitive to voltage regulation. It is important to establish carefully design limits of voltage for:

1. Steady-state regulation.
2. Transient dip caused by motor starting.

15-V Spread Permitted

Allowable steady-state voltages for the conventional system were based on the voltage profile, Fig 4. The favorable zone described by the EEI-NEMA preferred voltage report is 125 to 110 v at the utilization device. This is a spread of 15 v. The voltage profile considers the first customer and the first distribution transformer on the primary feeder at ½ load. All other transformers are assumed to be fully loaded.

Voltage at the first customer's utilization devices must not exceed 125 with the regulator output voltage at the top of its band width. The last customer's utilization devices must receive not less than 110 v with the regulator output voltage at the bottom of its band width. Band width is assumed to be 2 v. Customer's service and interior wiring are assumed to have a 3.75-v drop. Voltage drop in the primary, distribution transformers, and secondaries is thus limited to 12.5 v. The lowest cost system is determined by simultaneous analysis of these system components within the total drop limits. The allocation of drops shown in Fig 4 for individual system components is illustrative and does not define exact limits.

Maximum Dip Not Defined

A somewhat similar voltage profile for the higher-secondary-voltage system is shown in Fig. 5. Only the voltage drop along the 265/460-v secondaries need be considered because drop in the 34.5-kv circuits within the area is negligible.

Maximum allowable voltage dip at a customer whose equipment is not causing the fluctuation is not clearly defined by the utility industry. A value of 2.5% was selected for the studies. Motor starting currents shown in Tables I and II were used to determine voltage dip at various load densities.

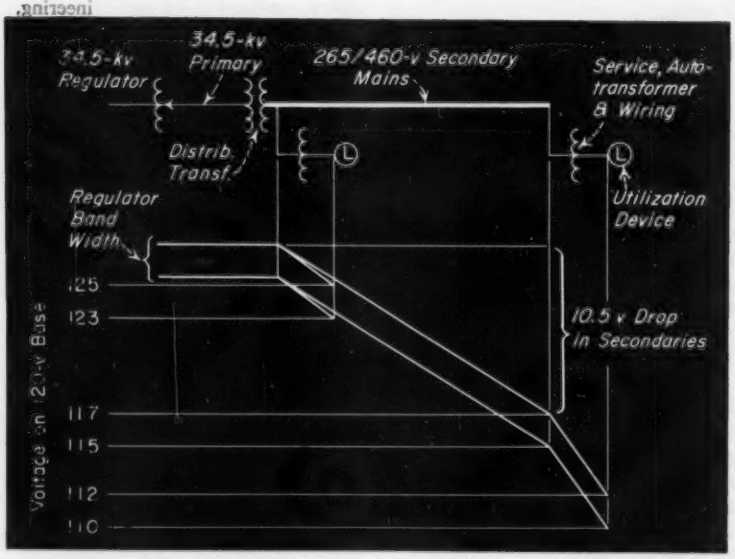


FIG 5—VOLTAGE PROFILE FOR 265/460-V SYSTEM permits 10.5-v drop in the secondaries while meeting conventional limits of voltage at utilization devices

The curve of average peak diversified demand per house as a function of the number of houses, Fig. 6, was used to determine load currents for calculating voltage drops and determining conductor sizes.

In determining distribution transformer ratings for the conventional systems, an application factor was used to relate the total distribution transformer capacity to the peak diversified demand on the feeder. For the 1.6, 2.5, and 5.0-kva-per-house load densities, an application factor of 1.5 was assumed. For the 10-kva load density, which approaches appliance saturation, the factor was dropped to 1.2. The application factor takes into account two variables in conventional system design:

1. Diversity among a number of customers.

2. Degrees of usage of electricity by customers supplied from a given distribution transformer.

Application Factor Lower

The application factor used for the higher-secondary-voltage system is lower than for the conventional system because of the ability of the higher voltage system to gather more load. Furthermore accumulated loads at the larger distribution transformers are of a more predictable nature when designing a system to serve an area with a given load density. The application factors assumed were 0.75 for 1.6 and 2.5-kva, 0.80 for 5 kva, and 0.87 for 10-kva load density.

Several studies were made of underground distribution systems for both conventional and higher secondary voltages. Direct burial of cables was assumed. Results are shown in Fig 7 in dollars per kva for the range of load densities studied. At the higher load densities the cost of underground distribution with the higher secondary voltage was less than the cost of conventional overhead 4-kv-to-120/240-v distribution. Local conditions may change this relationship.

Other studies confirmed that 3-phase, 120/208-v distribution in residential areas is very costly. Single-phase, 240/480-v distribution was studied on an area coverage basis and was found to be slightly more costly than the 3-phase higher-secondary-voltage system.

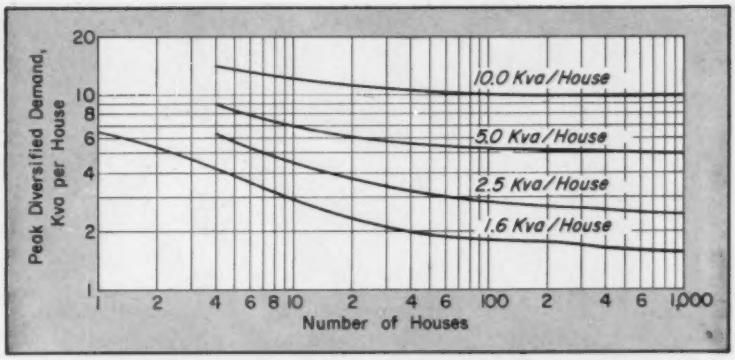


FIG 6—PEAK DIVERSIFIED DEMAND PER HOUSE guides design of distribution for heavy residential consumption. Diversity drops as the individual loads increase

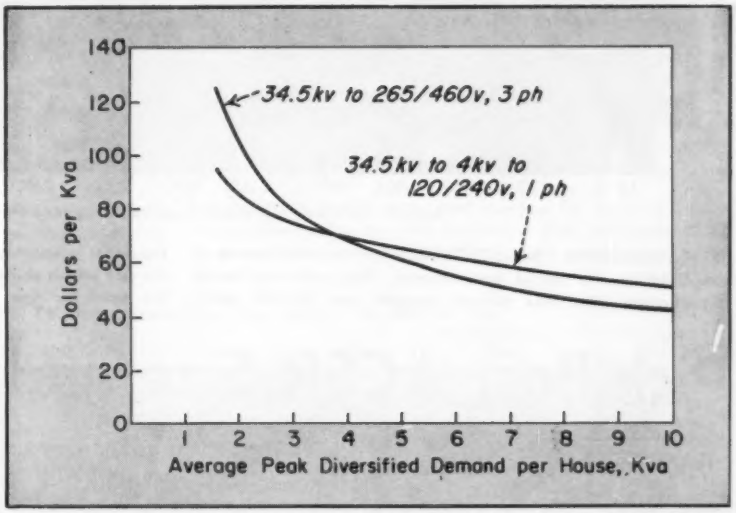


FIG 7—BURIED-CABLE UNDERGROUND DISTRIBUTION AT 265/460 V COSTS LESS than conventional 120/240-v overhead for the heavier residential connections

Table I—Motor Characteristics Used for Voltage Dip Calculations for 120/240-v Secondary Systems

	Load Density, Kva per House*			
	1.6	2.5	5	10
Inrush Current, amp	40	40	100	160
Inrush Power Factor	0.85	0.85	0.925	0.95
Motor Voltage	115	115	220	220
Horsepower	†	†	5	7 1/2

* Average peak diversified demand per house in a large area.
† 80% of motor inrush for ¾-hp, 115-v room air-conditioner.

Table II—Motor Characteristics Used for Voltage Dip Calculations for 265/460-v Secondary System

	Load Density, Kva per House*			
	1.6	2.5	5	10
Inrush Current, amp	20	20	45	60
Inrush Power Factor	0.85	0.85	0.575	0.55
Motor Voltage	230 1-ph	230 1-ph	440 3-ph	440 3-ph
Horsepower	†	†	5	7 1/2

* Average peak diversified demand per house in a large area.
† 80% of motor inrush for ¾-hp, 230-v room air-conditioner.

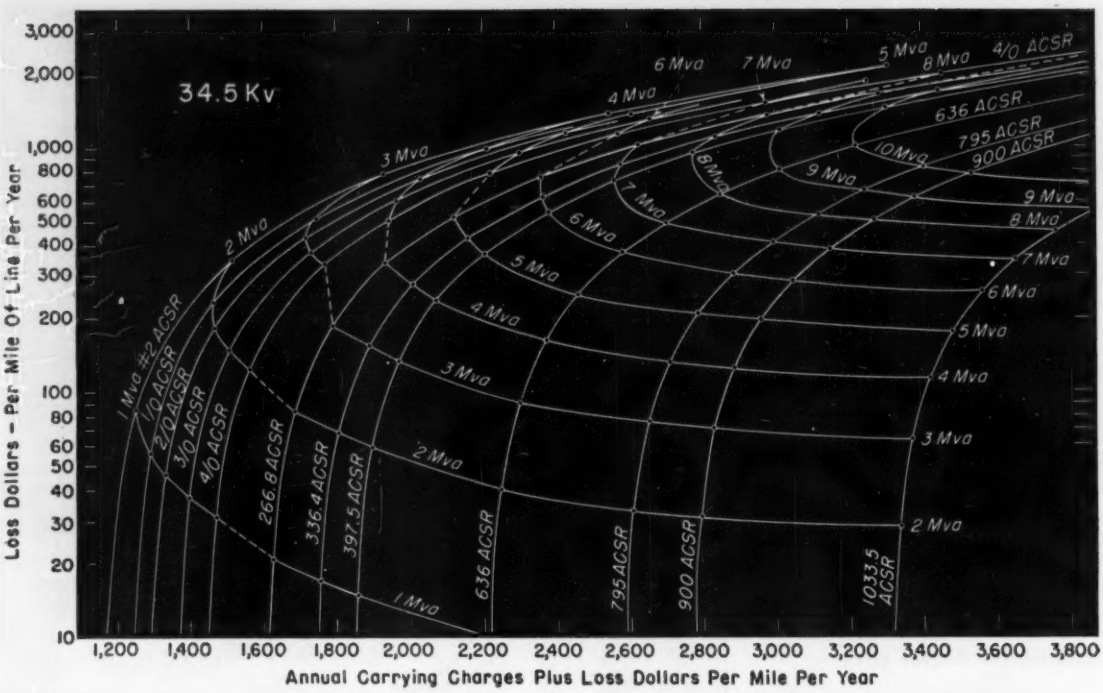


FIG 1—CHOOSING CONDUCTOR SIZE for 34.5-kv circuits is simplified by the use of these curves. They plot the carrying charges plus loss dollars against loss dollars only. The most economical conductor for any given Mva load is the one which shows the lowest total cost, or the one having the point for that specific Mva load farthest to the left

Pick Best ACSR Size and Voltage

TRANSMISSION Design

Charts based on varying line costs facilitate Wisconsin P&L's economic selection of ACSR for 34.5, 69, 138-kv transmission

A. J. SHAFER, Engineer, and **H. J. VICK**, Engineer, System Engineering Department, Wisconsin Power & Light Co, Madison, Wis.

Charts developed for the Wisconsin Power & Light Co system pinpoint variables and give clear-cut cost figures for economical ACSR conductors sizes for transmission voltages. They display four variables simultaneously and show at a glance what effect a change in any one has on total cost.

Annual line and conductor carrying charges and the cost of losses resulting from power flows over the lines were major outlays considered in the study which developed the curves. Annual carrying charges in dollars per year per mile of line were based on these five-year averages:

1. Rate for carrying charges on lines and conductors.

2. Investment for lines including right-of-way and ground conductors but not phase conductors.

3. Investment for phase conductors.

Line charging was credited to carrying charges as it is an asset replacing shunt capacitors.

Loss calculations included initial peak load at the period's beginning, along with a growth factor based on an annual load growth of 7%. Load factor was evaluated at 4,400 hours per year, and I^2R and I^2X losses as the sum of varying flows for the hours in the years of that period.

Peak Load Losses Largest

Power cost included production costs and annual carrying charges on generating equipment. As losses are maximum during peak loads, when they require additional installed generating capacity, the calculations included annual carrying charges on the extra generating capacity. Reactance losses, I^2X, for which switched static capacitors can compensate were obtained by assuming a reactance of 0.8 ohm per mile per phase for all lines.

Total annual average cost of lines was the sum of average annual carrying charges and average annual loss dollars. This sum was the basis of curves in Fig 1, 2, and 3, indicating most economical conductor sizes. In the calculations use of costs per mile was sufficient:—terminal equipment cost, being identical for all conductor sizes at the same voltage, was not needed.

Curves for each conductor size give the most economical sizes. In these per-mile cost of losses for a particular conductor size at a given voltage appear as the ordinate, and the abscissa represents the line's cost of losses plus carrying charges. Loss calculations were based on the line load at the time of the study, plus 7% per year load growth. Cost of power was figured at 1¢ per kwhr. Reactive

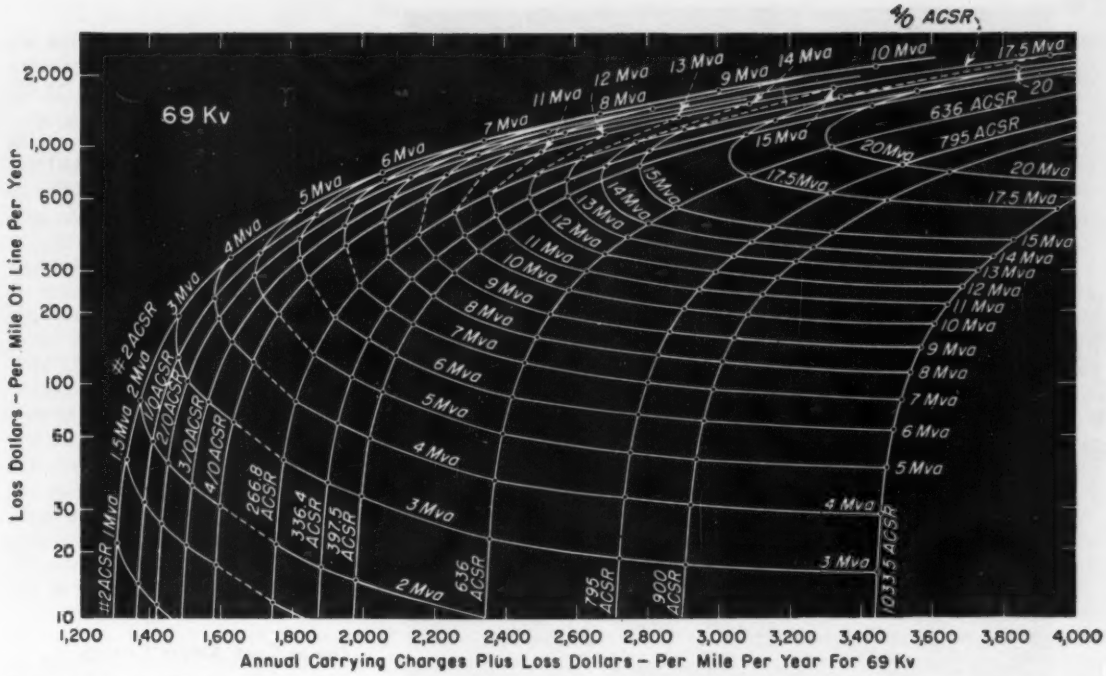


FIG 2—FOR 69-KV CIRCUITS conductor size is selected from the above curve. In developing this curve, investment and losses were figured for the 69-kv level, but annual charges, load growth, power costs, and charges for reactive power were calculated as for 34.5-kv circuits. The most economical size for given load is farthest to the left on this Mva curve

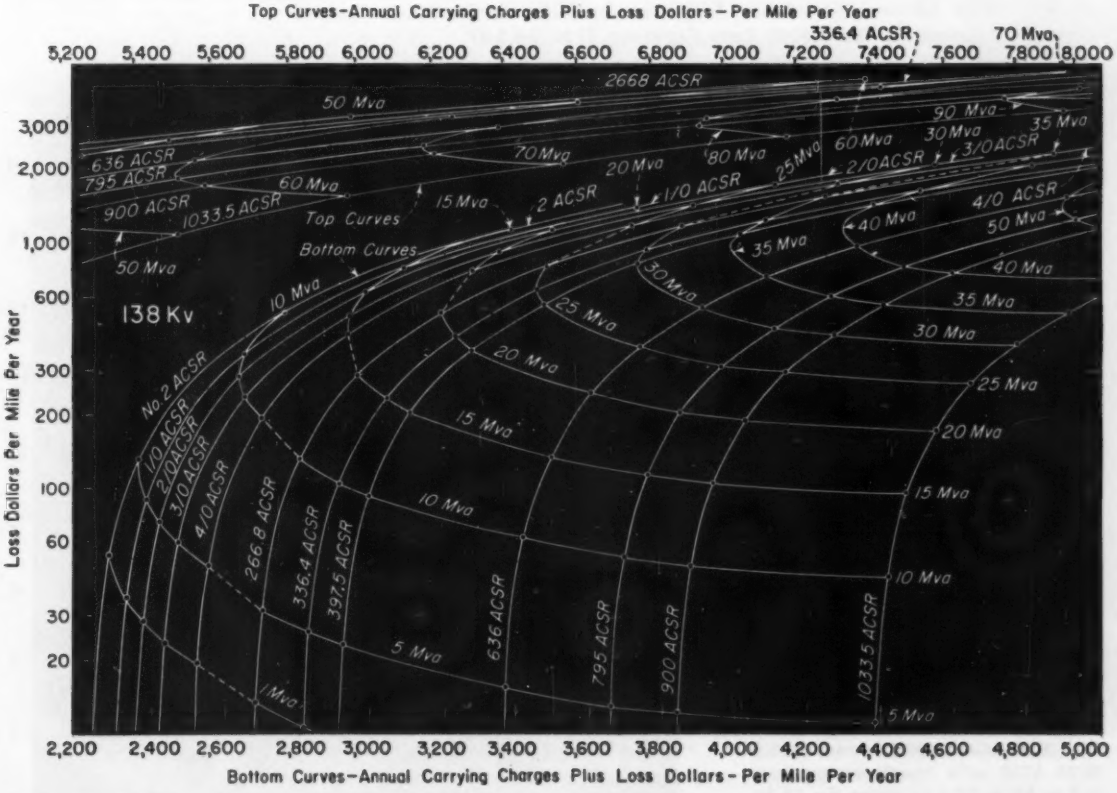


FIG 3—FOR 138 KV most economical conductor size can be selected from curves above. These curves were developed like those for 34.5 and 69 kv, by relating load, conductor size for the costs of losses and total comparable charges

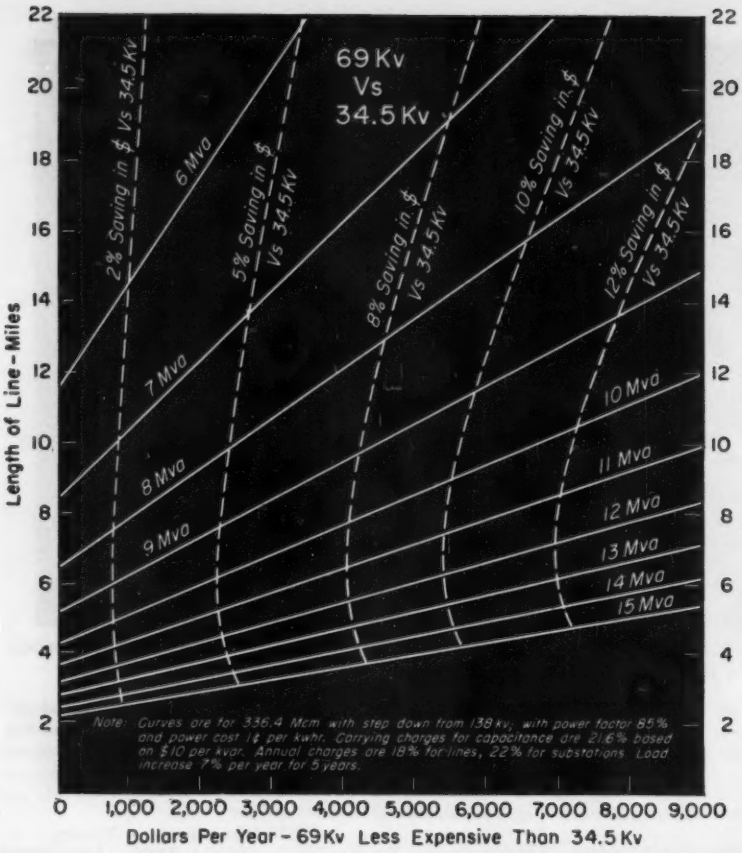

69 Kv
Vs
34.5 Kv
2% Saving in $ Vs 34.5 Kv
5% Saving in $ Vs 34.5 Kv
8% Saving in $ Vs 34.5 Kv
10% Saving in $ Vs 34.5 Kv
12% Saving in $ Vs 34.5 Kv
6 Mva
7 Mva
8 Mva
9 Mva
10 Mva
11 Mva
12 Mva
13 Mva
14 Mva
15 Mva
Note: Curves are for 336.4 Mcm with step down from 138 kv, with power factor 85% and power cost 1¢ per kwhr. Carrying charges for capacitance are 21.6% based on $10 per kvar. Annual charges are 18% for lines, 22% for substations. Load increase 7% per year for 5 years.
Length of Line - Miles
Dollars Per Year - 69 Kv Less Expensive Than 34.5 Kv

FIG 4—ECONOMICAL CIRCUIT VOLTAGE is determined by plotting load curves in Mva, using length of line in miles as ordinate and annual cost advantage of 69 vs 34.5-kv as abscissa. Curves shown are in area where savings are effected by using 69 kv on the line

power costs were based on $10 per kvar investment for shunt capacitors, on which annual charges were 21.6% per year.

In Fig 1, for example, annual charges on No. 2 ACSR are $1,165.1 per year. When losses are $10, the point on the No. 2 ACSR curve is $1,175.1. When losses are $20, the point is $1,185.1. Thus, as load increases, the annual losses increase.

On the curves for each conductor size the points on each were determined for each load—1 Mva, 2 Mva, and up for the loads considered. Joining points for each load develops a curve indicating the conductor size costing least for any given load. The point on the Mva curve farthest left gives the conductor size with minimum total costs. Thus the curve gives both the specific conductor size desired and the trend in costs at any point.

Power Cost Alters Curves

The Mva curves break at the transition from single-layer to two-layer conductors, effective resistance changing with the number of layers of aluminum. Changes in the cost of

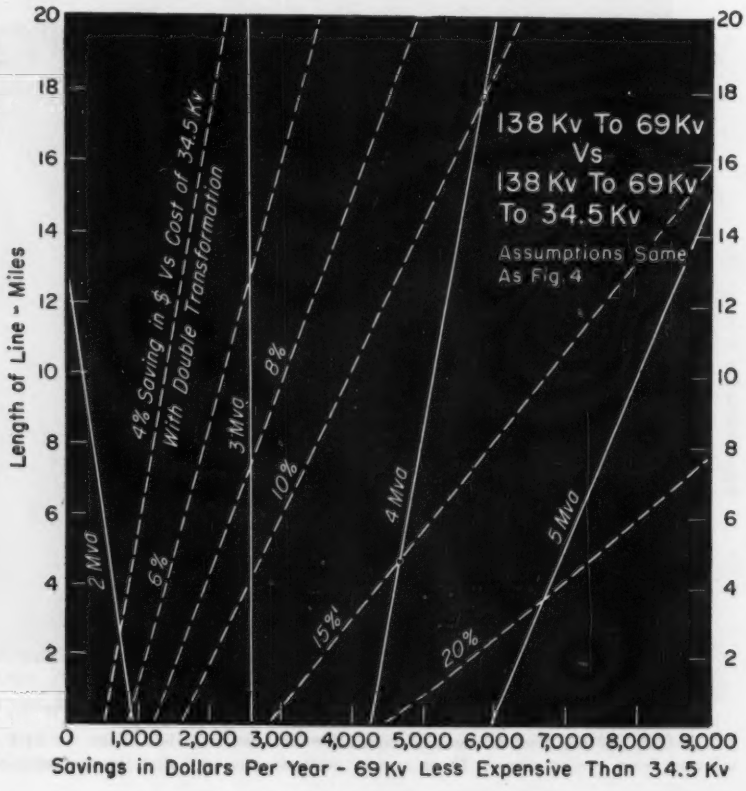


FIG 5—CALCULATIONS using 336.4 MCM ACSR with transformation from 138 to 69 to 34.5 kv shows the 69 kv to be more economical than 34.5 kv for the Mva load ranges indicated on chart

power alter the positions of Mva curves. When the cost of power is one-fourth of that used in plotting these curves, for example, the new Mva curves occupy the positions of half values on the curves for 1¢ power. Thus 10 Mva at ¼¢ power takes the position of 5 Mva at 1¢ power. For all changes where power costs become $1/a$ of the original cost, the new Mva curve is in the position of $1/\sqrt{a}$ of the original curve.

Other Costs Estimated

The effect of changes in factors other than power costs may be estimated also. If any quantity—resistance, loss factor, or load growth factor—is reduced by applying $1/a$, the new curve is in the position $1/\sqrt{a}$ of the original. Lowering the voltage by $1/a$ raises the Mva curve by a. Decreasing the time raises the curve. The curve is raised not only by the reduction in time but also by the load growth factor which changes with the time.

Changes in annual charges shift the conductor curves with respect to each other. This shift, pertaining only to the cost of the conductor, may be relatively small. Outlays for poles and other equipment for one size of conductor were considered to be proportionately the same as for all sizes. The effect of a change in annual carrying charges is greater for larger conductor sizes because of the larger investment involved.

Charts Reflect Changes

A reduction in annual charges moves conductor curves closer together and provides inducement for the increased use of larger conductors. The reverse is true when annual charges are increased. It is doubtful, however, whether a change in annual charges would be large enough to be especially significant in affecting the conductor size required. In any event, the charts are a graphic method furnishing a clear picture of what happens as the factors change.

Equipment Included

In determining the most economical voltage, total comparable costs were obtained from a summation of the line annual carrying charges and annual loss dollars for a specific voltage, conductor size, length of line, and Mva loading. These calculations were made for the two voltages under consideration and included terminal equipment.

When the difference in the total cost at each voltage had been determined, Figs 4, 5, and 6 were plotted These show savings for given loads through the use of the higher voltage. In the charts the ordinate represents length of line in miles, the abscissa savings in dollars per year. As the curves pass out of the area of savings at the higher voltage, it is evident that the lower voltage line is the more economical.

Percentage Savings Shown

Percentage curves were plotted by joining points on the Mva load curves for the same percentage savings through use of the higher voltage. Percentages were based on costs at the lower voltage. These percentage curves afford a picture of the comparable costs at both voltages. Here again, as percentage savings at the higher voltage approach the zero point, it becomes apparent that the area where the lower voltage is more economical has been reached.

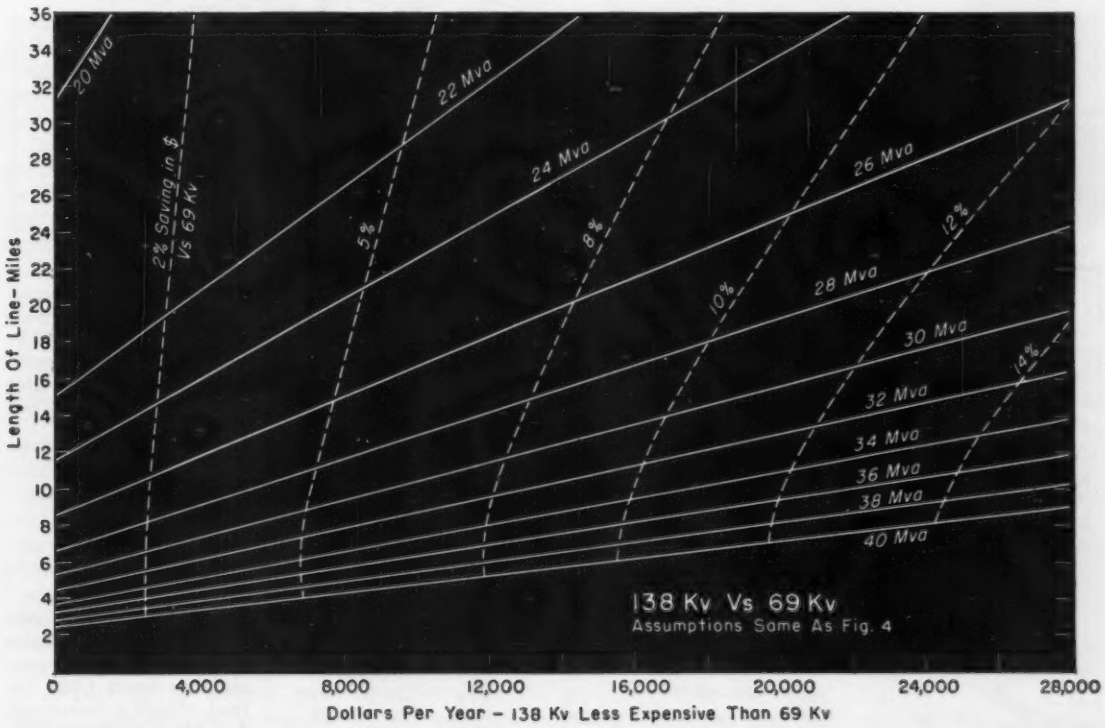


FIG 6—TRANSMISSION COSTS are less with 138 than with 69 kv in these Mva curves, when 336.4-MCM ACSR conductor is used. Percentage lines show savings with 138 kv. As the curves move into left area 69 kv becomes more economical

330-Kv Power Systems Apply

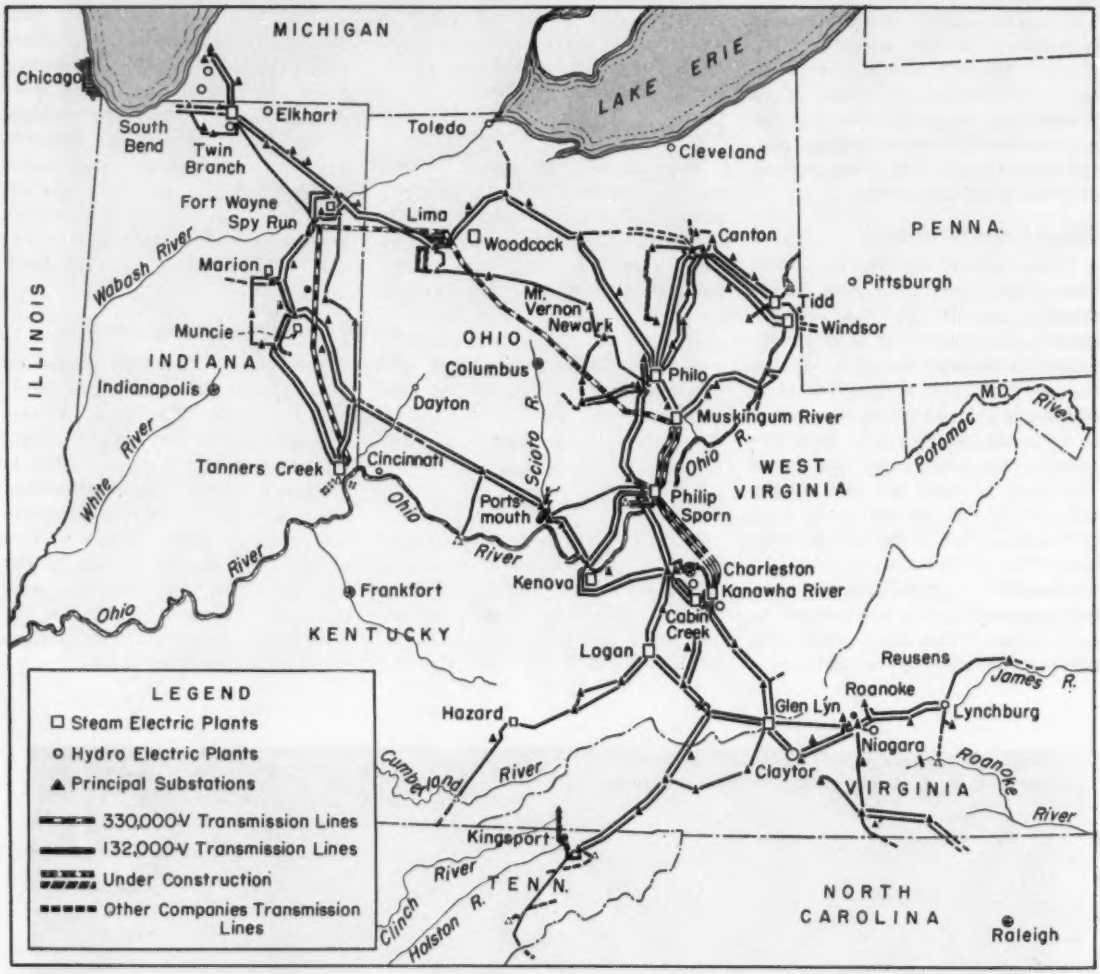


FIG 1—AMERICAN G&E superposes 330-kv circuits over 132-kv and lower voltage system. New 330-kv lines extend from Kanawha River, W. Va., across Ohio to Ft. Wayne and Tanners Creek, Ind.

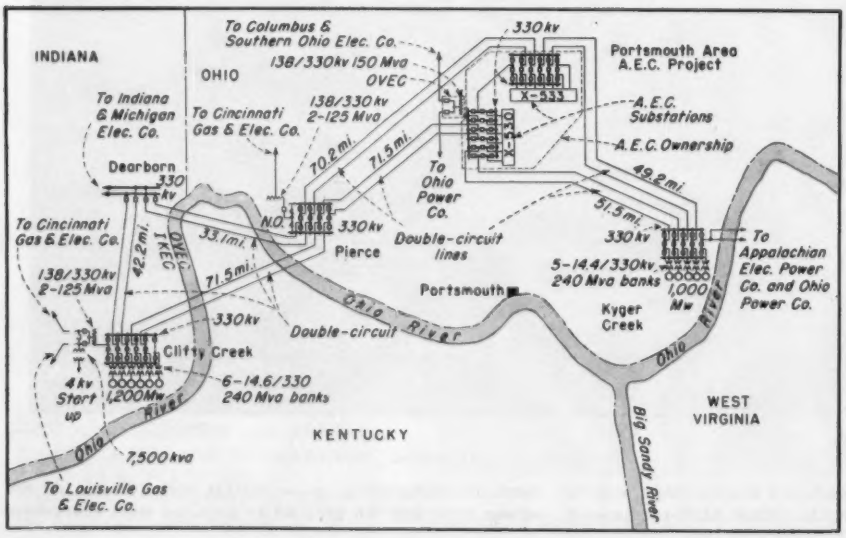


FIG 2—OVEC BUILDS 389 mi of double circuit 330-kv lines from new power plants to supply 1,800 Mw load of AEC's Portsmouth Area Project. System has direct interconnection with 6 participating systems

New Knowledge

- **Fundamental research guides extrapolation of design data to EHV. Systems total 649 mi in service and 228 mi under construction**
- **Operating experience tests design principles, reveals precautions needed to avoid RI**
- **Lightning flashovers in excess of predictions spur re-examination of EHV design methods**
- **Sleet melting proves successful using 132 kv to heat 50 to 85 mi of 330-kv line**
- **Relay protection depends on carrier for fast clearing, backed up by two separate two-zone impedance schemes**
- **Field tests prove breakers re-strike-free**

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W. S. PRICE, Electrical Research Engineer, American Gas & Electric Service Corp, New York, N. Y.

Establishment of 330 kv as a transmission voltage, the highest in this country, by the American Gas & Electric Co has presented an array of problems requiring both analytical and laboratory investigation. Many of these problems required fundamental research in unknown areas. All solutions adopted so far are subject to the acid test of actual operating experience where any unforeseen weaknesses will ultimately be revealed.

Construction of the AG&E 330-kv system was started in 1951. The design was developed from theoretical studies, the results obtained from various laboratories, and from a special 500-kv outdoor test station at Tidd Station of Ohio Power Co. The first line was energized at 330-kv in October 1953; today there are 260 towerline miles in operation and 228 miles under construction. Fig 1 shows this 330-kv system superposed on the existing 132-kv system.

Major generating plants are located along the Ohio River and its tributaries where coal and water are in ample supply. The transmission system must link these plants and provide economical bulk transmission of their output to load centers as much as 175 miles distant.

Before the first AG&E line was actually energized, a new problem arose which required immediate solution. This was the generation and transmission of power to the Portsmouth, Ohio, Area Project of the Atomic Energy Commission. Ohio Valley Electric Corporation, jointly owned by 15 private electric utilities, was set up to supply 1,800 Mw to this project. By this time results of the AG&E research and development program were available and demonstrated the technical feasibility of 330-kv transmission. Economic studies by OVEC likewise proved favorable to 330-kv which was accordingly adopted.

Fig 2 shows the 330-kv OVEC system. There are 389 miles of double-circuit lines, all of which were placed in service between August 1954 and June 1955. The system is directly connected to the AG&E 330-kv system at Tanners Creek Plant of Indiana & Michigan Electric Co and at Kyger Creek Plant of OVEC. It is connected through autotransformers to the 132-kv systems of Cincinnati G&E Co, Louisville G&E Co, Columbus & Southern Ohio Electric Co, and Ohio Power Co. Through these facilities it interconnects with the other companies of the participating group.

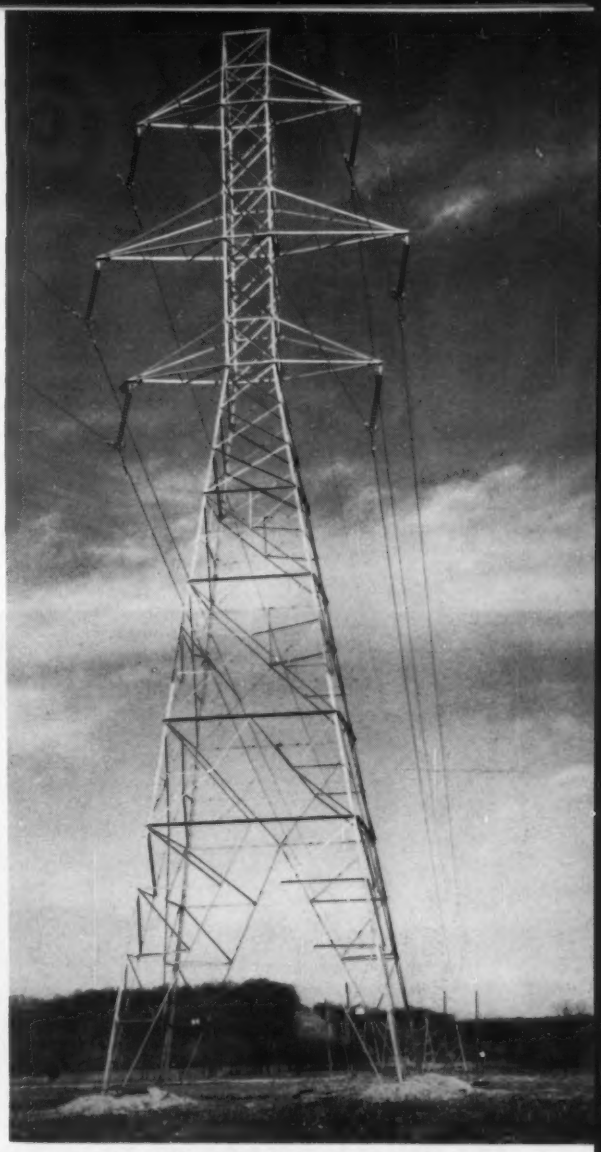


FIG 3—TOWERS OF INITIAL 330-KV support two circuits of 1.6-in. ACSR. Strings have 18 insulators.

Initial Construction and Experience

The type of construction chosen for the initial AG&E lines was based on double-circuit construction with 1.6-in. expanded ACSR conductors. Fig 3 shows one of the towers. Construction of these lines was performed in the same general manner that has been followed on the 132-kv system. Initially the conductors were pulled out along

the ground, careful attention being given to protecting the conductor from abrasion but with no special effort to keep the cable absolutely clean.

The first line to be energized at 330 kv for test purposes was the Sporn-Muskingum circuit in October 1953. When this line was energized, radio influence measurements were higher than had been anticipated as a result of the Tidd tests. This was attributed to several causes. During stringing operations the conductors had picked up some dirt and abrasions. It was also discovered that the paper filler contained excessive saturant which had seeped out to the cable surface. It was decided to increase conductor diameter from 1.6 to 1.75 in. on lines where conductor stringing was not yet under way, to reduce the amount of saturant in the paper filler, to take greater precautions against abrading the wire during the stringing, and to pay careful attention to hardware surfaces.

To insure that the conductors were kept clean and free

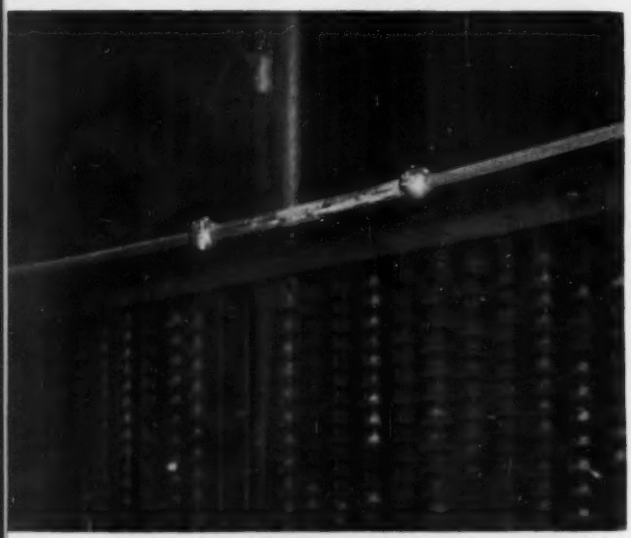


FIG 4—LABORATORY TESTS PROVE NEED FOR 5-IN. SPHERES to suppress corona at the ends of conductor splicing sleeves

of abrasions during stringing, it was decided to keep the cable off of the ground at all times. Two methods were followed. The first involved erection of wooden horses at proper intervals, depending upon the terrain, to keep the conductor clear of the ground. These supports were from 4 to 6 ft high and made of two uprights and a cross piece.

This method proved satisfactory after initial problems were solved. A tendency for conductor strands to birdcage (loosen outer strands) in passing over the barriers was avoided by careful grading of the horses and application of a slight braking action on the cable reel. Any loose particles of metal or dirt which might have collected on the cable during shipment were removed by brushing machines having motor-driven nylon brushes and capable of brushing 3 cables at the same time. Adjustable speeds and individual controls for each cable were incorporated in the design. The brushing machine was placed in line with the reels and conductors were fed through this machine while being pulled out over the wooden horses.

A second method, using tension stringing to keep the conductor off the ground without the use of intermediate barricades, was also tried on some of the lines. This method also included brushes to clean the cable, but these were installed on the tension machines themselves.

Radio Influence Investigations

In addition to these precautions and the increase in conductor size, an intensive investigation of various factors entering into the radio influence problem was carried on looking toward possible further improvement in design. The basic problem is to design a system which will permit satisfactory radio reception to users along transmission lines where broadcast signal strength varies widely at different locations. Satisfactory reception is dependent on the ratio of broadcast signal strength to line-generated noise.

Line noise—being a mixture of impulse and random noise—has an amplitude roughly inversely proportional to frequency. Therefore the problem is chiefly that of protecting broadcast receivers in the 540 to 1,600-kc band. FM broadcasting at 88 to 108 Mc appears to be no problem at all because the noise level at these frequencies is so far below the level at AM broadcast frequencies and also because of the inherent noise-limiting characteristics of FM. Television, being transmitted in bands between 54 and 88 Mc and 174 to 216 Mc, is not a serious problem but must be watched, particularly on the lower channels.

So many factors govern the extent of radio influence on a transmission line that it is extremely difficult to determine a representative level. A multitude of measurements have been taken on lines in service aimed at evaluating the effect of different factors and verifying theoretical calculations of such variables as line voltage, conductor height, distance of receiver from line, effect of standing waves at radio frequency, atmospheric conditions, conductor aging, and phase positions of conductors on double-circuit lines.

An important improvement was achieved by changing the phasing of the lines. AG&E practice on 132-kv double-circuit lines has been to arrange phases 1-2-3 from top to bottom on one circuit and 3-2-1 on the other to obtain minimum line reactance. This practice was followed initially on the 330-kv lines. But changing to the same phase sequence on both lines achieved a 9% reduction in voltage stress at the surface of the top conductor and 7% on the bottom conductor; the middle conductor stress is unchanged. Corresponding RI measurements show 40% reduction. The increase in system reactance was of negligible importance and all lines have accordingly been changed to obtain the benefit of the reduced RI.

Energized Service Cuts RI

It has been suggested that energized lines will tend to have lower RI values with the passage of time, presumably because minute irregularities on the surface which help to generate disturbances are gradually burned off. Observations on the OVEC and AG&E lines have not yet been carried on long enough to evaluate this fully, but results indicate that a reduction is occurring.

Although not a major source of RI, hardware was laboratory tested with 25 ft of conductor and modified where necessary to insure that the voltage at which corona

started was above that at which conductor corona started. A typical modification was made on splicing sleeves which, although originally designed without sharp corners, were found to require a 5-in. sphere at each end to obtain the required results.

Lightning Performance of 330-Kv Lines

Eighteen 5¾-in. insulators on the 330-kv lines provide a critical impulse flashover level of 1,585 kv. The single ground wire provides a shielding angle of 35 deg. It was expected that with such insulation and shielding the 330-kv lines would be relatively immune to lightning flashovers provided tower footing resistances were reasonably low. Applying the AIEE method to the parameters of these lines gives an expected rate of 0.5 flashovers per 100 line mi per yr.

The number of flashovers caused by lightning has, however, exceeded expectations. For example lines of the OVEC system flashed over at a rate of approximately 8 per 100 line mi per yr during the 1955 lightning season. All these flashovers occurred at towers with footing resistances of 7 ohms or less.

These flashover rates are of the same order of magnitude as rates of the AG&E 132-kv system in the same area. As on the 132 kv-system, these 330-kv flashovers have not caused any operating difficulties such as loss of load or instability. And no such difficulties are expected because ultra-high-speed-reclosing circuit breakers, first developed for the AG&E 132-kv system some 20 years ago, have been used for the 330-kv system.

The discrepancy between predicted and actual lightning performance of the 330-kv lines has, however, prompted a re-examination of the entire mechanism of transmission line flashovers. Critical evaluation of the performance data has shown that the concept of voltage drop in the tower footing resistance does not account for the performance because most of the flashovers have occurred at towers with only a few ohms resistance. Neither does it appear that a large percentage of the flashovers has been caused by shielding failures. One concept which is being examined is that lightning current flowing through the surge impedance of the tower will produce flashover voltages in the initial fraction of a microsecond before multiple reflections in the tower eliminate this voltage.

Intensive analytical, laboratory, and field investigations have been started or projected which may, within the next few years, provide an improved picture of electrical events which follow a lightning stroke to a transmission line. An account of one of these investigations, made by the Ohio Brass Co., was presented in EW Sept. 5, 1955, p74. The ultimate objective of these investigations is to establish a line design which will be more truly "lightning proof."

Sleet Melting Proves Successful

All the 330-kv lines are located in territory where sleet can form on the conductors. It is essential that this sleet either be prevented from forming or be removed before it has become heavy enough to cause permanent damage to the lines.

Sleet melting has been handled on 132-kv lines by applying sufficient current to the conductors to melt the ice. Two basic requirements are a means of detecting the existence of sleet and a means of obtaining sufficient current to melt it. Detection is accomplished by measuring the attenuation of a carrier current signal. Melting current is obtained by applying 132 kv to one end of an appropriate length of line and short-circuiting the other end.

The 1.6 and 1.75-in. conductors used on the 330-kv system require higher current to accomplish the melting than on the 132-kv system. Fig 5 shows the relation between time and current required to melt various amounts of glaze for 1.75-in. conductors. These curves indicate that the melting time becomes objectionably long below 1,400 amp. Maximum permissible current is limited to about 1,800 amp by the current-carrying ability of terminal facilities and the amount of reactive power available at the source. The current is obtained by applying 132 kv to the 330-kv line section to be melted, with 3-phase grounding switches closed 55 to 85 miles away. This procedure has been applied successfully several times.

In some cases it has not been possible to obtain required melting current initially which will be available in the future when construction is completed. It was possible, however, to obtain current in the order of 750 amp by short-circuiting a greater length of line. While this is insufficient to melt ice, it will prevent its formation. This method has been employed successfully on two occasions. Its proper use depends upon adequate weather forecasting and the exercise of judgment by system dispatchers and involves more extended outage of the line than is required for sleet melting at higher currents.

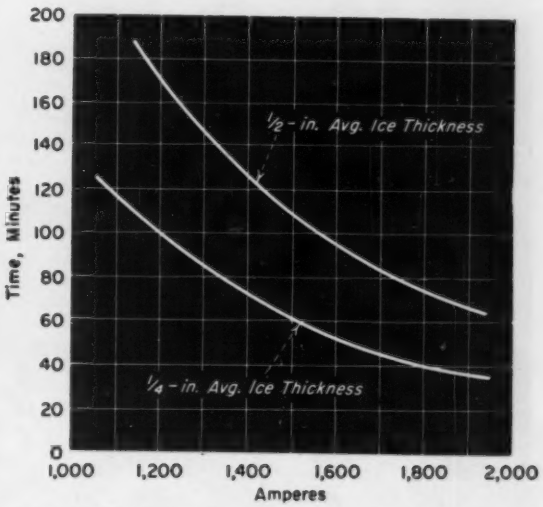


FIG 5—SLEET MELTING OF 1.75 IN. 1,414 MCM ACSR requires over 1,400 amp for a reasonable period of line interruption

Sleet melting requires that normal protective relaying be disconnected and simple overcurrent relays substituted to clear accidental short circuits which might occur along the line. Furthermore the abnormal switching involved to connect 132 kv to 330-kv equipment requires adequate interlocks to prevent any possibility of applying 330 kv to 132-kv equipment through an operating error.

Key to this safety feature is a sleet melting control switch for each line to be melted. This switch must be

operated before the sleet melting switching can be set up. It cuts out the normal protective relays, cuts in the sleet melt relays, permits closure only of the proper circuit breakers, and trips any necessary equipment if a manually operated disconnect should be closed in a position that would cause a fault or apply 330 kv to 132-kv equipment. The switch also prevents restoring the line to service until it has been returned to its normal operating position.

Relay Protection Equals That for LV Lines

Relay protection for a 330-kv system must recognize the same basic requirements of operating speed, sensitivity, steady-state and transient load carrying ability, and reliability as have existed for lower voltage systems. Short circuit duty, however, exceeds any ever encountered before and requires circuit breakers of 25,000-Mva interrupting capacity. Terminal equipment, such as circuit breakers and transformers, is much more expensive. These factors, together with the greater amount of load affected by a short circuit, made it essential to re-examine the philosophy of backup protection. For all locations a failure of any element of the primary protective system to disconnect a short circuit must be followed by tripping in the shortest possible time of all other breakers required for isolation of the fault.

Primary protection for the transmission lines is directional-comparison carrier current using "mho" type impedance elements for phase protection and product directional elements in series with overcurrent elements for ground protection. It is expected that after a trial period has been completed electronic carrier-current relays having similar characteristics but faster operating time will be employed on the longest AG&E 330-kv line.

Normal backup relays for rapid clearing if the carrier relays are inoperable are two-zone, "mho," impedance-type relays for phase protection plus simple plunger-type overcurrent relays to assure fast clearing of heavy faults near the bus. Ground relays are product-type, potential-polarized for the first zone and directionally controlled, inverse-time overcurrent for the second zone. These backup relays are completely independent of the carrier relays.

A second set of backup relays with a slight delay clears other equipment when the normal protective equipment fails to clear a short circuit. For identification purposes these are called "breaker failure relays," though it is recognized the failure may not be the fault of the breaker. Their current and potential circuits are supplied normally by different transformers from those supplying the normal backup relays, and their battery tripping circuits are separately fused.

Fig 6 shows a typical 1-line diagram of the protective relaying for a transmission line. Fig 7 shows typical time and distance settings for the backup phase relays. It can be seen that, even when all normal equipment fails to trip, the fault will be cleared by breaker failure relays in 15 cycles for 80% of the line and 45 cycles for the remaining 20%. Thus the results achieved are:

1. Relay operating time for normal conditions of from 0.7 to 1.4 cycles. With carrier relaying out of service it

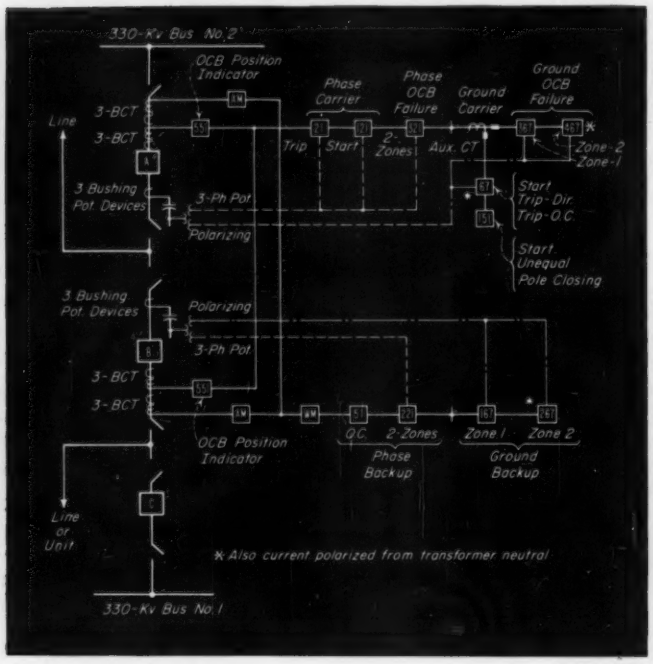
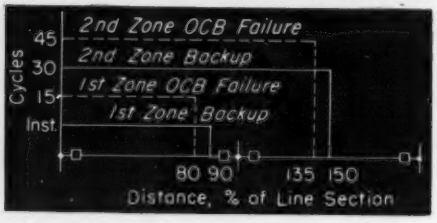


FIG 6—RELAY INSTALLATION FOR 330-KV LINE terminal uses directional-comparison carrier with impedance relays for primary protection. First backup is 2-zone impedance relays with plunger overcurrent relays for heavy faults. A second backup functions to clear at more remote points when these two relay systems fail to remove any fault within a reasonable clearing time

FIG 7—TIME AND DISTANCE SETTINGS of phase relays provide coordinated fast protection for 90% of adjacent line section and 30-45-cycle backup beyond end of the adjacent line section



is from 2 cycles maximum for the first zone to about 30 cycles for the second zone.

2. Insurance against failure to clear because of failure of any primary tripping element. Breaker failure relays initiate tripping of other breakers to clear the fault in about 15 cycles for the first zone and 45 cycles for the second.

3. High load carrying ability by the use of "mho" type distance relays. Most lines can carry in excess of 1,500 Mva at 0.8 pf.

Field Tests of Circuit Breaker Performance

The high degree of service reliability required on these 330-kv systems made it desirable where possible to test new designs of equipment under operating conditions. To this end extensive tests were made to determine the performance of the 330-kv OCB's when interrupting line charging current, particularly with respect to the frequency of occurrence of re-strikes and re-ignitions, and the effect of such duty on interrupters and bushings.

These tests were made at the Dearborn Station of the OVEC system. At this location it was possible to connect line lengths of 42, 114, and 185 miles to the OCB under test. Fig 8 shows one of the 25,000-Mva, reduced-oil-content breakers tested. A total of 103 line-dropping operations was made on this breaker, during which oscillograms were obtained of line-charging currents, line-to-ground voltages on both sides of the breaker, and voltages across the breaker terminals. The duty on the OCB during these tests was completely representative of operating conditions because system loading was normal and no extraneous test equipment was connected to the line side of the breaker.

Fig 9 is a typical oscillogram showing interruption of 225 amp of line-charging current produced by the 185-mi line section. No re-strikes occurred after the initial current zeros. It is also interesting to note that, after initial current zero, line potentials are maintained at full crest magnitude by trapped charges on the line. Other tests in this series indicated that this potential drops to approximately 30% of normal crest voltage after 1 min and disappears after 2 to 5 min following initial current zero.

This breaker was completely re-strike-free as no instances were recorded in which line current was resumed after a zero-current interval of ¼ cycle or longer. Re-ignition occurred when the contacts parted less than 0.2 cycle before current zero; that is, the line current resumed after a zero-current interval of less than ¼ cycle. But because the intervals of zero current prior to the re-ignitions were extremely short (less than 0.04 cycles) no overvoltage occurred.

These tests confirmed development tests and provided assurance that these breakers will successfully perform all line-dropping operations which will occur in service, without producing dangerous overvoltages.

Conclusions

Careful evaluation of the 330-kv system and equipment performance is continuing. Those features where further improvement can be obtained are being investigated. The rather brief experience so far gives every indication that the general design criteria have adequately provided for the operating requirements and that the voltage selected will most economically serve transmission requirements for many years in the future.

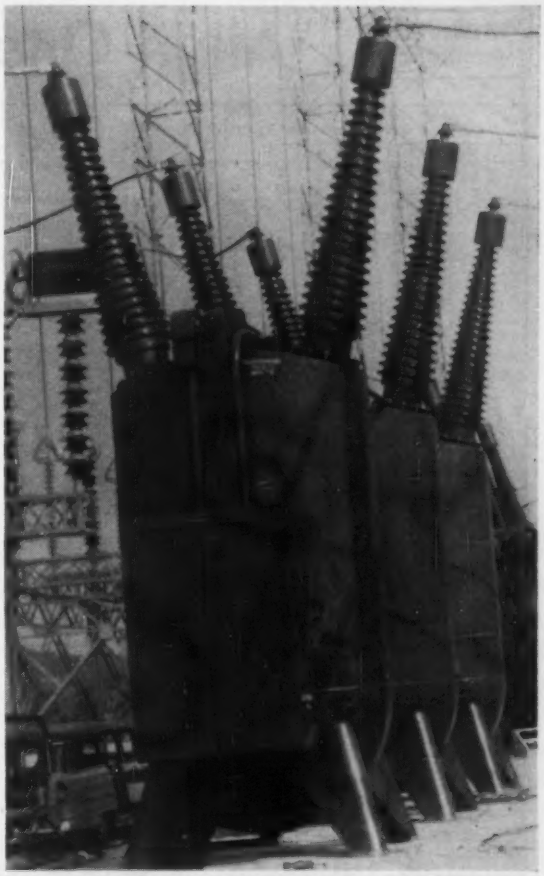


FIG 8—LINE-DROPPING TESTS PROVE 330-KV BREAKERS suitable for service on both of these high-capacity systems

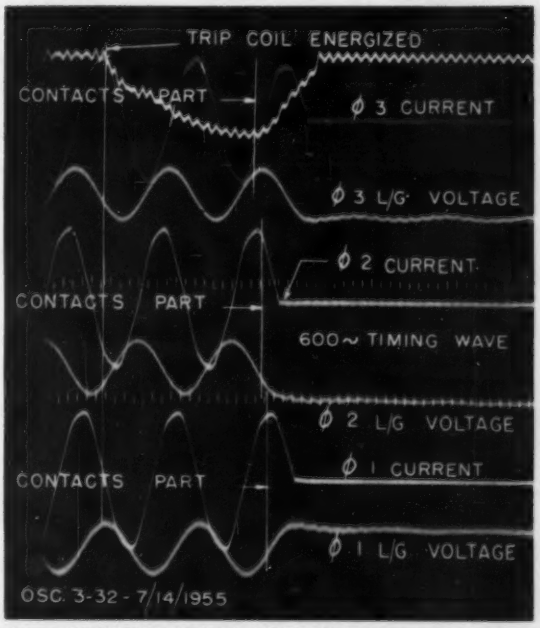


FIG 9—OSCILLOGRAMS OF LINE-DROPPING show breakers clear normal line current without re-strikes or over-voltage

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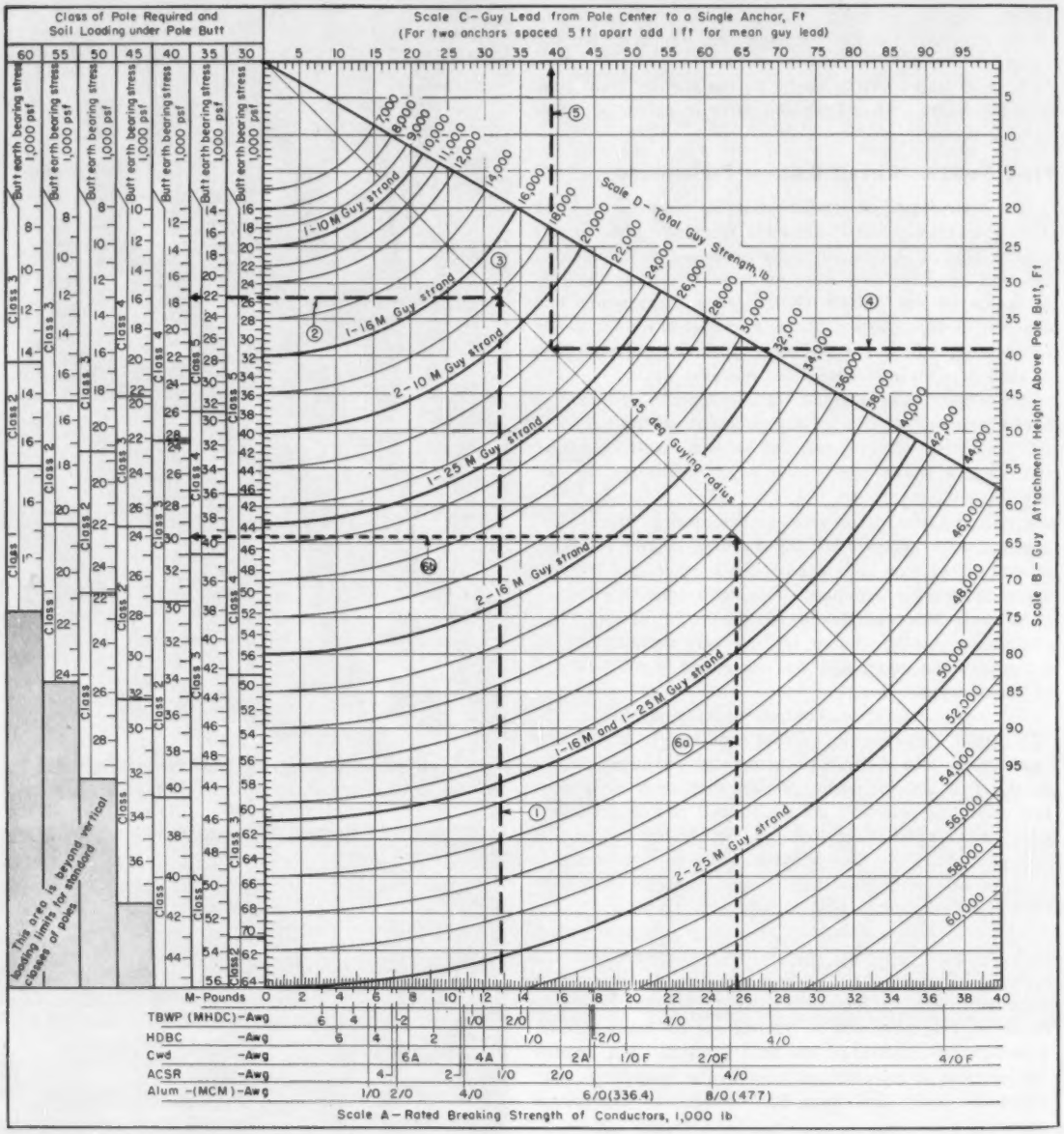
Construction

"All in One" Guying Chart and


Class of Pole Required and Soil Loading under Pole Butt
Scale C – Guy Lead from Pole Center to a Single Anchor, Ft
(For two anchors spaced 5 ft apart add 1 ft for mean guy lead)
Butt earth bearing stress 1,000 psf
1-10M Guy strand
1-16M Guy strand
2-10 M Guy strand
1-25 M Guy strand
2-16 M Guy strand
1-16 M and 1-25 M Guy strand
2-25 M Guy strand
45 deg Guying radius
Scale D – Total Guy Strength, lb
Scale B – Guy Attachment Height Above Pole Butt, Ft
This area is beyond vertical loading limits for standard classes of poles
M-Pounds
TBWP (MHDC) –Awg
HDBC –Awg
Cwd –Awg
ACSR –Awg
Alum –(MCM)–Awg
Scale A – Rated Breaking Strength of Conductors, 1,000 lb

How to Use the Guying Chart

Assume the deadending of three 1/0 ACSR conductors, flat construction, on a 40-ft pole. Recommended 45-deg guying is to be used.

1. From Scale A at 1/0 ACSR, project a vertical line to 45-deg guying radius line.

2. From this intersection, project a line to the 40-ft column. Thus Class 4 is the smallest pole which can be used. Butt earth bearing stress would read 17,600 psf.

3. In step 1 the point of intersection with guying radius line is above arcs for both 2-10M guy strand and 1-25M guy strand. This allows use of either, but 1-25M is recommended rather than the double guy.

4. On a 40-ft pole with flat construction the guy is attached about 1 ft from the pole top or 39 ft above the pole butt. Thus, from the 39-ft line on Scale B project a line to intersect the guying radius line.

5. From this intersection project a vertical line to Scale C and read 39 ft as the guy lead. When a guying angle other than 45 deg is used, this value from Scale C will differ from that for Scale B.

6. For a line corner of any angle guyed in line each way, determine the corner pole size by starting on Scale A at double the value for 1/0 ACSR and continuing as above. Thus a Class 3 pole or larger is required. Butt earth bearing stress would read 29,860 psf. Note that the guy attachment height and guy lead still remain at 39 ft.

Note: For average firm earth it may be necessary to set a concrete pad under the pole when a butt earth bearing stress of 40,000 psf or more is read on the chart. Less firm soils may require a pad for chart readings of less than 40,000 psf.

Pole Guide

K. H. WOODS, Senior Engineer, Distribution, Southwestern Public Service Co, Amarillo, Texas

Most important factor in a deadend assembly is the strength built into it. This strength should be as great as or greater than the rated ultimate strength of all conductors the assembly supports. The guying assembly, therefore, should not fail before line conductors break.

Rated strength of the guy strand is used by Southwestern Public Service Co as the basis for selecting proper combinations of guy strand, anchors, rods, and attachments. However, pole selection for a deadend is not so simple. Pole strength requirements are governed by number, type, and size of conductors, guy slope, and height of conductor and guy attachment.

Chart Contains Essential Elements

The accompanying guying chart and pole selection guide incorporates these factors in their proper relation to other associated factors. Use of the chart is a matter of matching proper equipment and values.

Contained in the design of the chart are all essential elements involved in a normal guyed structure design: **1.** Conductor (three) **2.** Guy strand (SPS standard ratings) **3.** Pole length and class **4.** Soil loading **5.** Angular relation of guy to pole **6.** Guy attachment height **7.** Guy lead. All items are noted visually on the chart, and they are in their correct locations, according to their respective values, for performing their proper functions.

Explanation of Elements

The chart is based on a combination of graphic trigonometry and rated strength of conductor, guy strand, and pole. Rated breaking strength of three of each type and size of conductor is on Scale A. The arc representing the rated breaking strength of each guy or combinations of guys is on Scale D. At the left of the chart are represented proper classes of seven different pole lengths to fit varying conditions.

These elements are used in conjunction with the guying radius line, which represents the guying angle, to obtain proper coordination in component values. Strength representations of conductors and guy strands are from standard published values. Pole strengths are from calculations made according to Euler's formula for the determination of allowable loading on wood columns according to their stiffness.

Soil Loading

Vertical load limits for each class of each pole are placed on the chart so that the minimum safety factor is 1.25. Butt earth bearing stress, or soil loading, as read on the chart will show whether soil loading relief is needed. General practice indicates that 40,000 psf as read on the chart is a reasonable design limit under the average deadend pole. The chart is based on rated breaking strength of conductors which are design sagged for a maximum of 25% ultimate tension at 60 F. This means an average continuous soil loading design limit of about 10,000 psf. Special consideration must be given to deadending H-frame structures, transformer structures, or any installation where small movement might be objectionable.

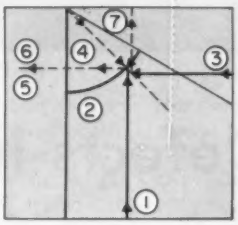
Three Examples Illustrate Chart Use

New line construction generally permits use of recommended values in deadending circuits. But field conditions sometimes dictate that other values be substituted. In rebuilding, the designer must work new materials onto existing lines or may have to use existing materials on revamped lines. Therefore, it may be advantageous to show how the guying chart and pole guide may be used under different conditions.

In using the chart, height of conductors on the pole controls the pole length and guy attachment height. It is assumed that for any installation the conductor to be used and the guy attachment height above the pole butt are both known. Thus in Example I, assume it is desired to determine if an existing guy strand could be worked into a revised deadend. In Example II, assume it is required to deadend certain conductors on an existing pole. And in Example III, assume there is insufficient space to guy at 45 deg and some lesser angle must be used.

Operating notes:

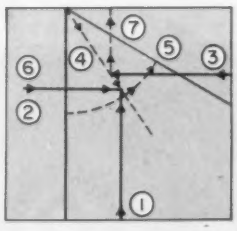
1. Use 45-deg guying whenever possible.
2. If downguying at a corner in two directions results in too much column loading on the pole, loading may be relieved with an overhead guy in one direction.
3. Excessive soil loading may be relieved by putting a concrete pad under the pole.
4. An increase in guy lead sometimes may allow use of one-size smaller guy and/or one-class smaller pole.
5. Lowering the guy and conductor attachment 5 ft increases the effective pole strength by one class. In using the chart, consider this as using a 5-ft shorter pole.
6. For guy and conductor attachments at different levels, their total effective loading adds directly and applies to the pole at the lowest attachment.



Example I

Given:
(1) Conductor to be used
(2) Guy strand to be used
(3) Guy attachment height

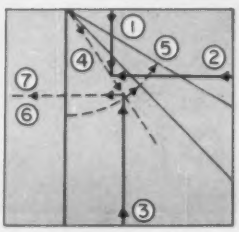
Find:
(4) Minimum guying angle
(5) Class of pole required for this angle
(6) Soil loading at pole butt
(7) Minimum guy lead



Example II

Given:
(1) Conductor to be used
(2) Pole length and class
(3) Guy attachment height

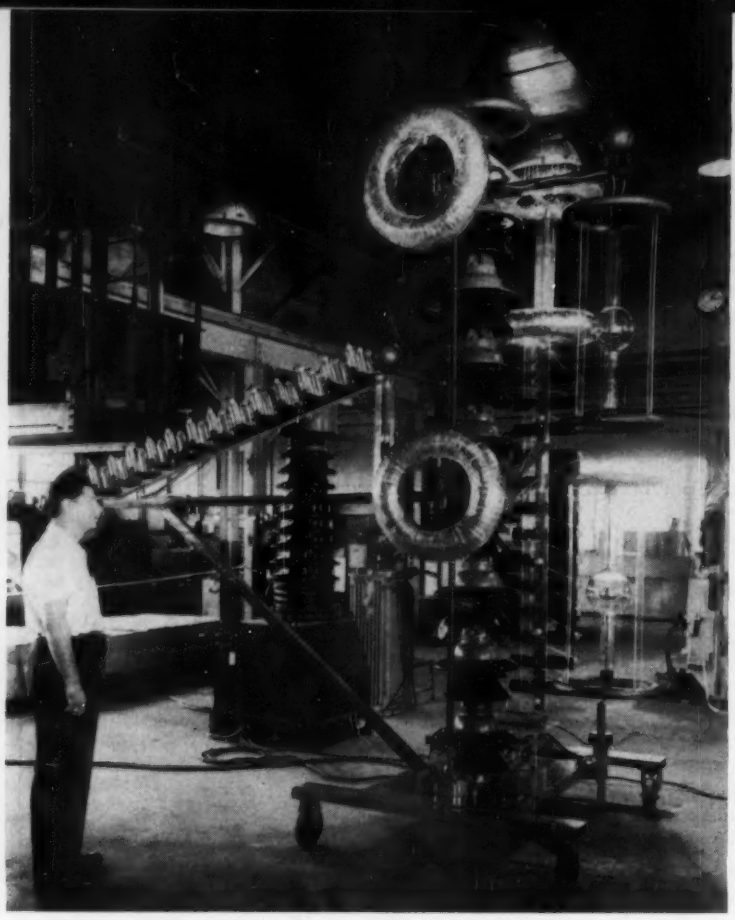
Find:
(4) Minimum guying angle
(5) Guy strand size
(6) Soil loading at pole butt
(7) Minimum guy lead

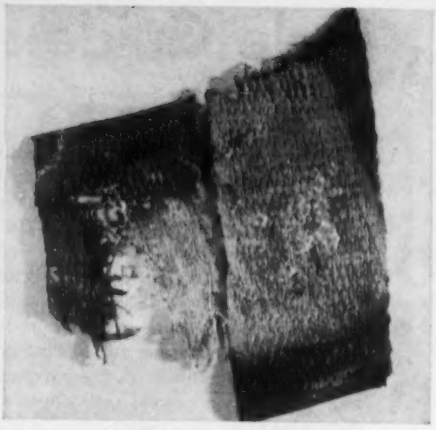


Example III

Given:
(1) Maximum guy lead allowed
(2) Guy attachment height
(3) Conductor to be used

Find:
(4) Guying angle
(5) Guy strand size
(6) Class of pole required
(7) Soil loading at pole butt





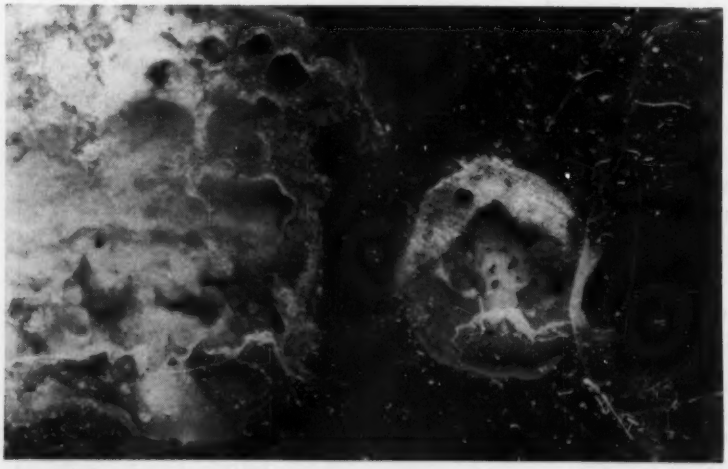
ASBESTOS TAPE burned by corona was revealed by the high-potential dc test

700-KV TEST SET tests insulation of insulators, alternators and bushings

DC Test Detects Insulation Weakness

GENERATION
Testing

Supplemental test shows turbogenerators repair needs before failure and provides trend values for probable remaining life

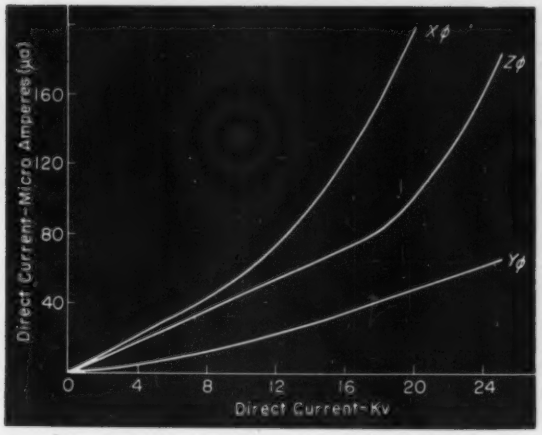


BREAKDOWN of insulation in a turbo-generator was detected by a dc test

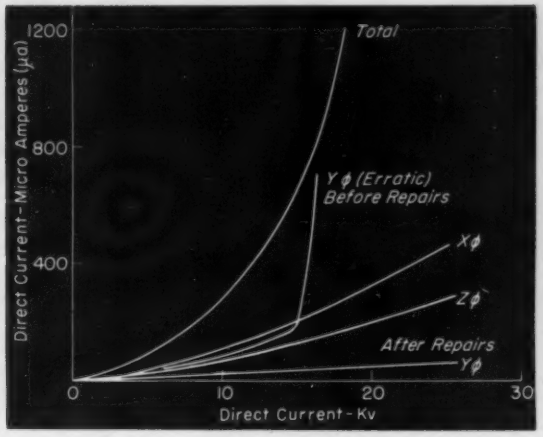
H. R. HARRIS and F. P. RHINE, Electrical Engineer, Detroit Edison Co, Detroit, Mich.

Advantages of high-voltage dc testing are apparent from experience of Detroit Edison Co with its use on large turbogenerators long in service. The Michigan utility, prompted by the experience of other companies, first used high-voltage dc testing on outdoor insulators exposed to contamination. Its application to bushings and rotating machinery followed. Detroit Edison uses the dc method to supplement other insulation tests.

The company found that the dc test affords a degree of leakage current measurement as fine as 0.1μa and has less deteriorating effect on equipment.



MOUNTING LEAKAGE CURRENT on two of three phases showed insulation deterioration of a 50 Mw alternator



IMPROVEMENT of same alternator's insulation condition is shown in Y-phase leakage current before and after repairs

Detroit Edison began with a 100-kv tester and followed up with a 300-kv test set. Now a 700-kv set is being built. As the company progressed up the voltage scale, it obtained more and more data.

Four Alternators Tested

Tests on four 50,000-kw, 12.2-kv, 3-phase alternators showed that the insulation on three units met standard requirements for continued operation. Tests on the fourth, a 28-year-old unit, revealed a definitely weak insulation condition on one phase. Decreasing insulation strength had been indicated over the preceding ten years by other standard tests. The dc breakdown was at approximately 19 kv, and the ac breakdown at approximately 12 kv, a method-to-method ratio of 1.6.

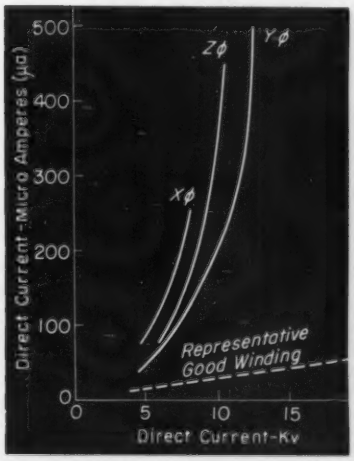
Repairs were confined to two top stator bars which had shown corona burning down into the bar insulation, largely at the entrance of the slot at each end. After repairs the leakage current of each phase was comparable to that of the three alternators scheduled for continued operation on the system.

Voltage Raised in Steps

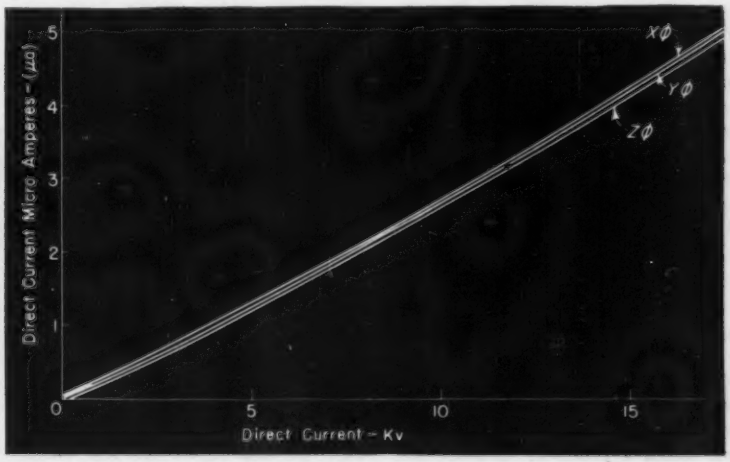
Examination of the insulation in the breakdown zone detected a definite deterioration caused by corona. Corona discharge concentrated at the sharp edge of the core at the end of the slot and bore through the asbestos and mica tapes.

The asbestos tape had not been coated with graphite or aluminum to afford a corona shield. Nor had the stator bar insulation been impregnated at the starting, ending, and midpoint through the insulation. Such coating and impregnating were not practiced at the time of winding this generator. As a consequence corona deterioration was more progressive.

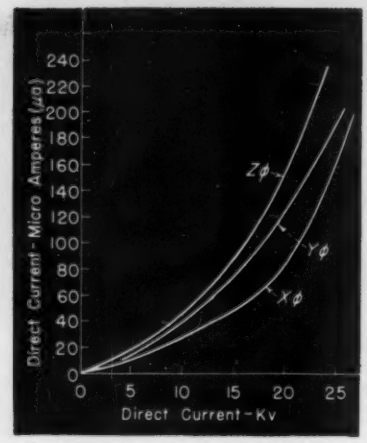
High-voltage dc insulation tests on old machines were carried out according to this formula: Two times phase-to-phase terminal voltage to ground on one phase with the other two phases grounded and the machine disconnected from all other equipment. For a 12.2-kv generator the dc test was at 24.4 kv, applied in approximately 5-kv increments and



DC LEAKAGE CURRENT rose sharply before stator of alternator was rewound



AFTER REWINDING of stator of 50,000-kw, 12.2-kv, 3-phase alternator the leakage current maintained a straight-line relationship as voltage was increased



BEFORE CLEANING 50,000-kw alternator dc test showed high leakage current

each step being held long enough to obtain stable leakage current for a given applied potential. The dc applied to new machines is 2.5 times phase-to-phase terminal voltage.

Voltage must be raised for each step of the high-voltage leakage current so that it does not go over the desired step. The condenser effect of the winding can give a fictitious value of the measured current and affect the slope of the current-voltage curve. Power supply voltage feeding the high-voltage dc test set must also be constant.

Repairs Indicated

Preliminary application of high-voltage dc to determine the trend of the current leakage curve is advisable. When the slope of the curve and magnitude of leakage current indicate defective insulation, the ac over-potential test can be continued to breakdown. In which event, however, repairs will be needed and the generator will have to be taken out of service, whether the over-potential is ac or dc.

In dc tests on a generator winding, the whole winding is subjected to the applied potential. This potential is considerably more than in some sections of the winding, such as the wye connection coils towards the neutral end and ground, experience during operation.

For this reason, an alternator may run a long time before breakdown with deteriorated insulation in the winding sections towards the neutral end which operates at relatively low potential. Nevertheless, as it is impracticable to separate windings into sections during high-voltage dc tests, the whole winding is tested. Discovering insulation weaknesses and correcting them before failure in service more than justify the cost of tests and repairs. Prevention of failures in service also cuts insurance costs and eliminates more extensive repairs.

A high-voltage dc test revealed that deterioration had progressed to many top bars of a 50,000-kw, 12.2-kv, 3-phase alternator which had run a great many more hours and at much higher ampere loads than the unit which had breakdowns of only two bars.

Detailed study was made of the insulation of this alternator, a 3-phase, 50,000-kw, 1,200-rpm, 12.2-kv machine about 27 years old. Practically all of the many stator bars broken down by either ac or dc potential were top members. Most breakdowns were on the terminal end at the end edge of the core slots. As top stator bars run hotter than bottom bars and as most of the breakdown was at the collector end of the slots, temperature was considered to be a chief factor in insulation deterioration.

Hot Spots Cause Trouble

In another high-voltage dc test on a 37,500-kva, 1,800-rpm, 12.2-kv, 3-phase alternator about 30 years old a general insulation deterioration had progressed so that breakdown occurred as low as 13 kv. Apparently this deterioration had been accelerated by hot spots in the stator core at certain phase belts.

Several years' records of insulation resistance and power factor tests had indicated that this generator had developed weak insulation. When the high-potential dc test confirmed this indication, a new stator winding was installed to prevent breakdown in service.

How general and to what degree deterioration has progressed in large turbogenerators of several years ago can be ascertained partly by measuring insulation leakage current during application of high-voltage dc and then determining the trend of the curves.

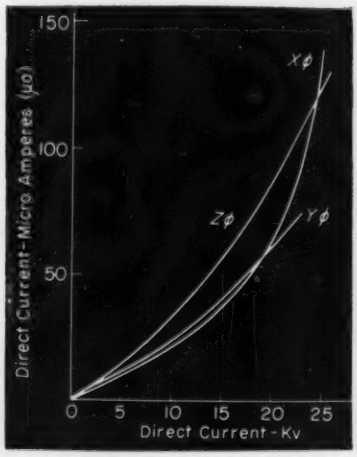
High-voltage dc tests have been applied to new alternators also. In some instances questionable leakage current curves had been obtained at time of installation. It was found several months later that these curves had flattened out and were of a satisfactory or near-satisfactory straight-line type. Moisture in the new winding, it was concluded, accounted for the leakage current curves of steep slope. After the machine had been running several months, the insulation had dried out.

Curves developed from data of a high-voltage dc test of a 50,000-kw alternator, similar to the one requiring a complete new winding, showed a rather high leakage current value. A decrease was noted in this value after the winding had been cleaned and particularly after the cleaning had been extended to the insulation around the terminals.

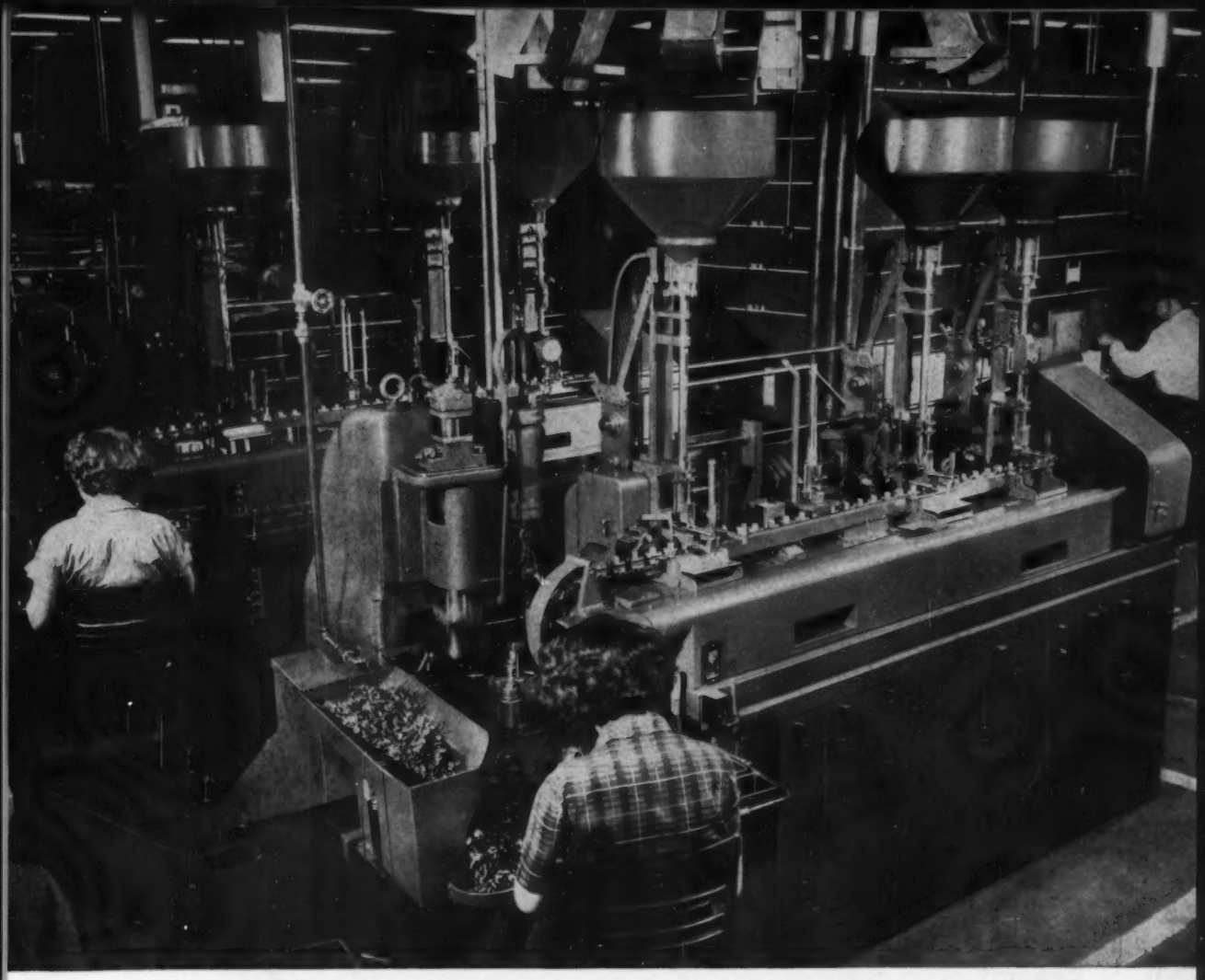
Increases Over 25 Kv

To prove this observation, an 18-kv ac 1-min high potential was applied to one phase at a time. The winding withstood it. A dc high voltage test was then applied to determine whether the ac potential had caused damage. Leakage current remained at the value obtained in the previous test, signifying the insulation was undamaged.

It was noted, however, that dc leakage current on one phase increased rapidly when test potential exceeded 25 kv. This particular winding was considered a borderline case that could last another year or longer and was worth the risk of running. In such cases, the advantages of both dc and ac over-potential are evident. Insulation condition made evident that this alternator had operated fewer hours than the one whose winding had been replaced.



LEAKAGE CURRENT of same alternator was acceptable after it was cleaned



"Automation . . . a way of manufacturing that raises productivity, upgrades workers' skills, improves quality, expands capacity, cuts costs."

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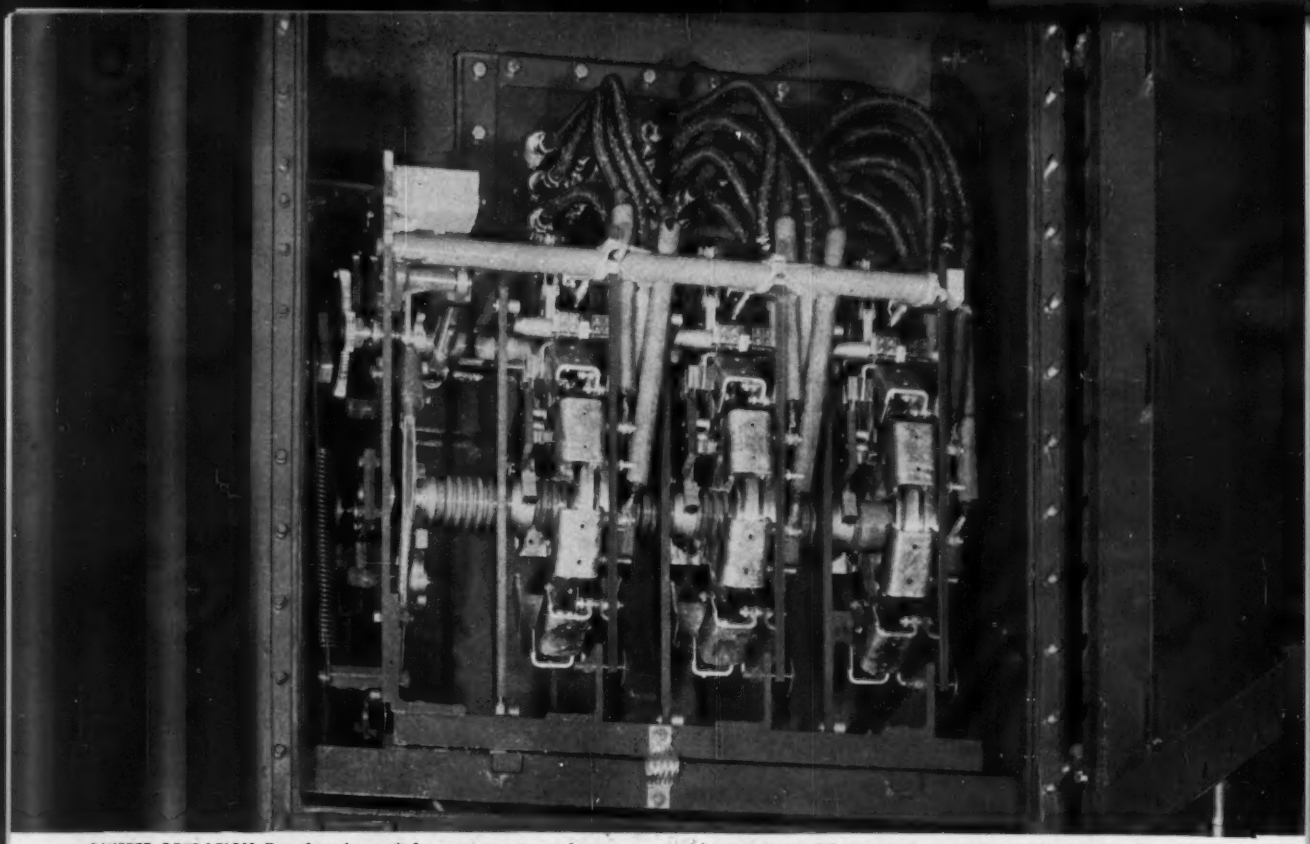
G.E.'s "More Power to America" program—of which this film is the latest—is designed to help industry increase productivity and reduce costs through greater use of electric power with new, improved production techniques.

For a preview, or details and prices on this new automation program, contact your electric utility or local G-E Apparatus Sales office, or write to General Electric Co., Section 350-4, Schenectady 5, N. Y.

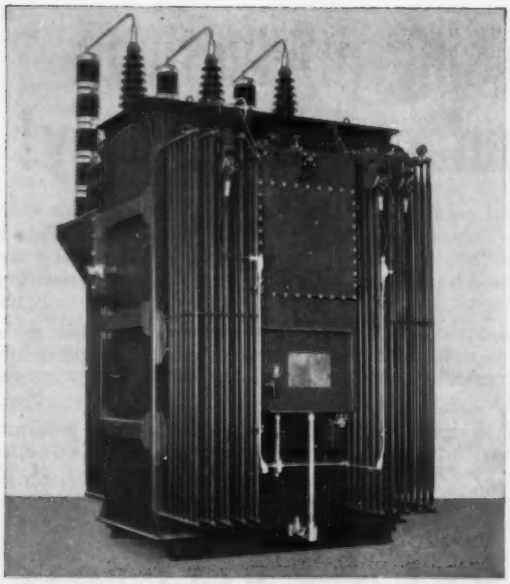
More Power to America

GENERAL ELECTRIC



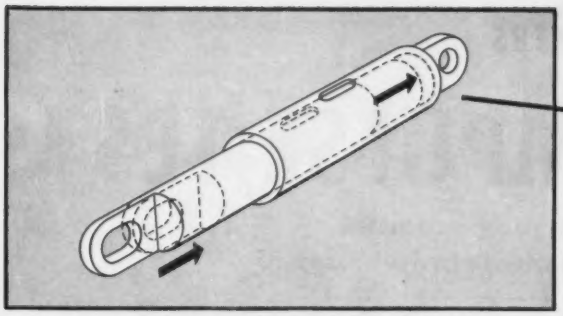
QUIETER OPERATION. Tap-changing switch compartment now houses motor and drive assembly completely immersed in oil to muffle noise and provide permanent lubrication. Formerly, motor plus assembly was in air-filled control compartment. Mounting under oil, and redesigning of geneva gear for smooth driving-pin entry—without impact—has cut peak noise level about 20 db.

Maintenance reduced 50% by new



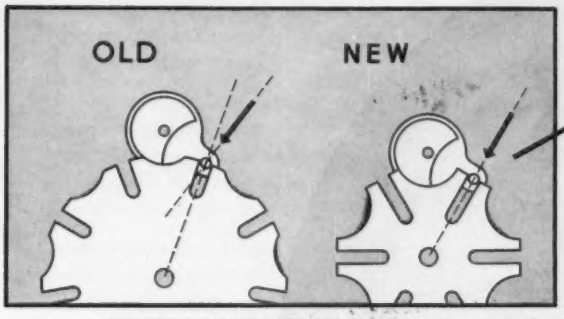
RM MEDIUM TRANSFORMERS employ the new LRT-68 load-tap-changing switch in LTC models.

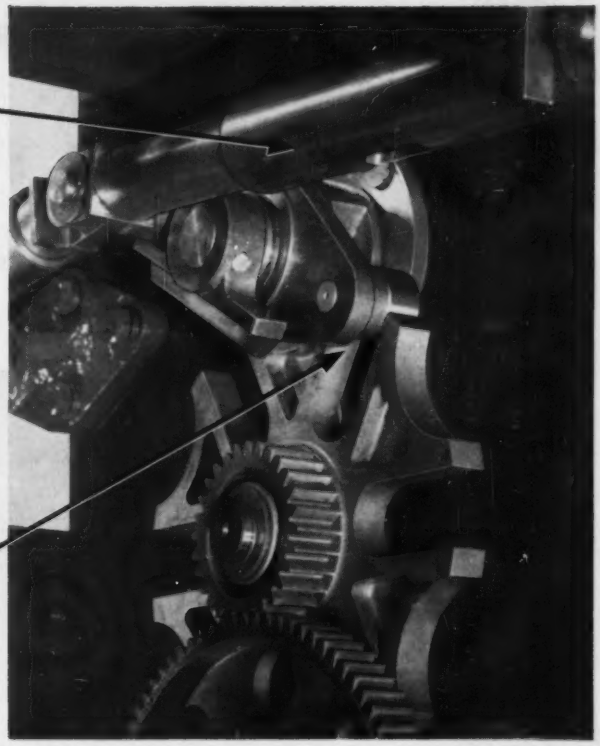
STEP REGULATORS up to 1000 kva will now have the added advantages of the new LRT-68 load-tap-changing switch.



HYDRAULIC DASHPOT

NEW GENEVA GEAR





REDUCED MAINTENANCE. LRT-68 incorporates new hydraulic dashpots and redesigned geneva gear. The two dashpots provide (1) optimum contact separation speed, and (2) reduced engagement velocity, for minimum contact erosion and less secondary arcing.

Geneva gear driving-pin now enters gear slot smoothly, parallel to the side of the slot. Previous design entered at 19° angle. Gentle acceleration and deceleration reduces jarring and mechanical wear. This, plus thicker contact tips, results in 100% increase in tip life.

General Electric load tap changer

Peak operating noise cut 20 db with LRT-68 switch now used on RM transformers and three-phase step regulators

DOUBLED CONTACT LIFE of General Electric's new LRT-68 load-tap-changing switch means routine inspection and maintenance can be *cut in half* on G-E LTC Medium Transformers, and on three-phase step voltage regulators up to 1000 kva.

These savings have been made possible by:
(1) reducing the amount of contact wear per operation, through redesigning the geneva gear (providing smoother operation) and adding hydraulic dashpots (for optimum separation and engagement speeds) and (2) using heavier, thicker contact tips, from which more material can wear before replacement is necessary.

REDUCED OPERATING NOISE results from a complete redesign of G.E.'s load-tap-changer. This means increased consumer good will and less investment in sound-absorbing walls and barriers, when LTC equipment is installed in residential areas.

For full information on this new load-tap-changing mechanism and the medium transformers and three-phase, step voltage regulators on which it will be used, contact your nearest General Electric Apparatus Sales Office, or write Section 416-4, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

DISTRIBUTION TRANSFORMERS

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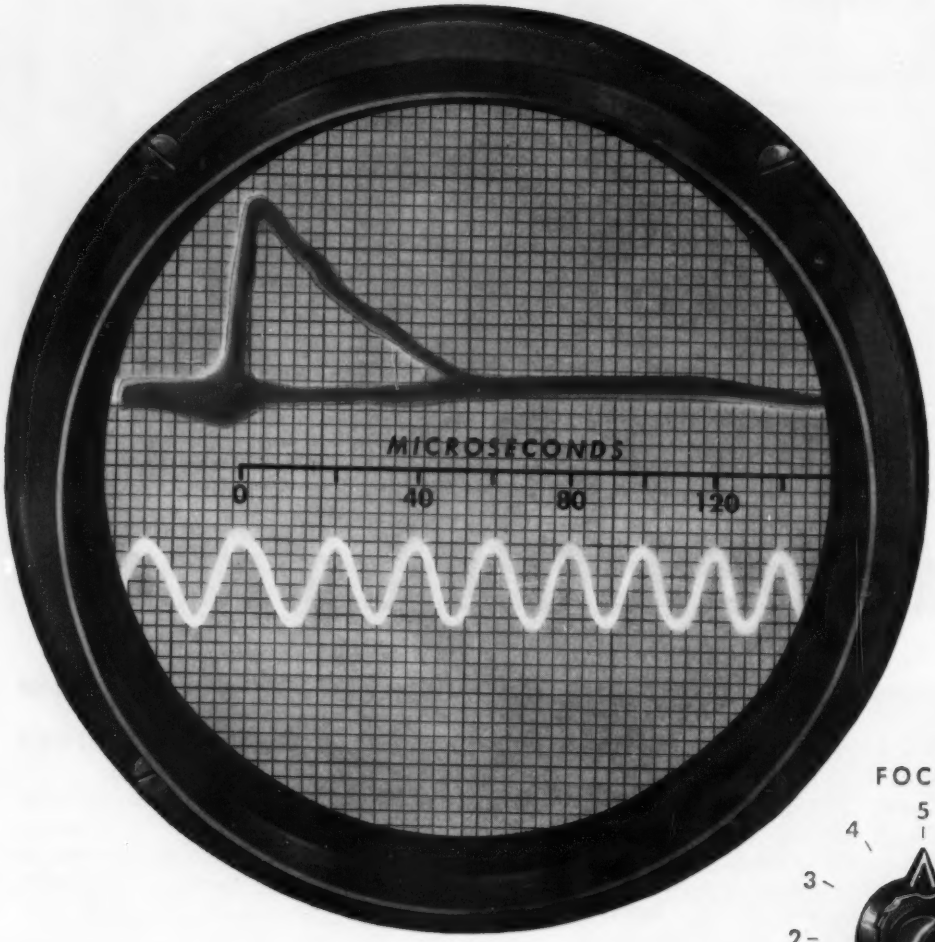

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COULD SAVE YOU...$45

Estimate your possible savings in terms of all transformers on your lines

When General Electric started production-line impulse testing its distribution transformers in 1946 more than 15% of the units were rejected. These units had previously passed **all other tests.** Had these transformers been shipped, they might have given years of satisfactory service under normal conditions, or they might have failed under sudden stress.

By weeding out failures in advance it is conservatively estimated that the average life of distribution transformers is increased 15%. Based on the cost of a 25-kva, 2400-volt unit this means a $45 saving on each transformer.

Impulse testing makes the difference. Every unit 100 kva and below has both high- and low-voltage windings tested on the G-E production line without lightning protection of any kind. Any hidden weakness is detected automatically and the faulty transformer is rejected. This means that every G-E distribution transformer you add to your system has already been proven under greater stresses than encountered in normal service.

Look at the other money-saving features that prove "All transformers are not alike": **One-piece clamping bands,** for instance, save maintenance time. Reusable **Nitrile rubber gaskets** help save units from contamination. **AL/CU terminals** are designed to prevent both copper and aluminum conductors from loosening. **Strenicor terminal clamps** save terminals from breaking. **Super Melaglyp paint** saves up to two repaintings. **Nationwide warehouses** save utilities heavy inventory expense. **Service shops** can cut your repair and rebuilding costs.

For the complete story contact your nearest G-E Apparatus Sales Office or G-E Agent—or write to General Electric Company, Schenectady 5, New York.

431-36

dollar-saving features prove ATANA*

*ALL TRANSFORMERS ARE NOT ALIKE
(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	√			√		√
Nitrile rubber gaskets	√					√
One-piece clamping band	√					
H-v and l-v terminals handle both copper and aluminum conductors	√					
Strenicor pressure terminal clamps	√					
Super Melaglyp paint	√					
More than 100 warehouses	√	√				
Nationwide, company-operated service shops	√	√				

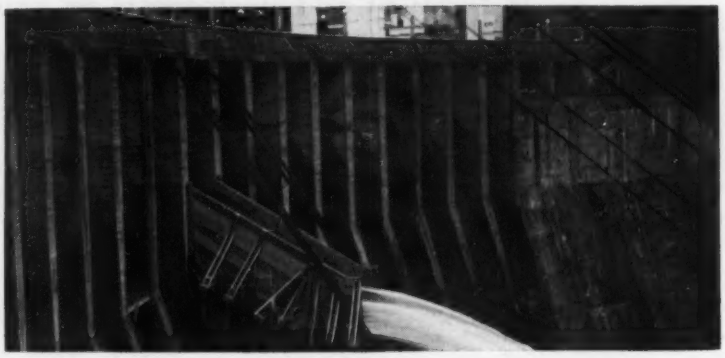
Progress Is Our Most Important Product

GENERAL ELECTRIC

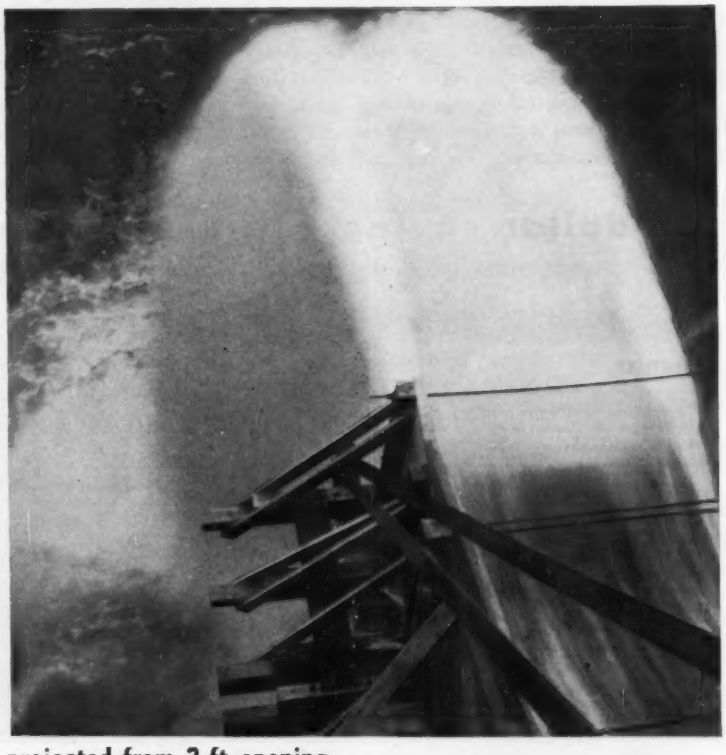
GENERATION—Maintenance

'Ski Jump' Gives Fish Safe Passage

A "ski jump" water chute promises safe passage for fingerling salmon past dams of medium height. Development of the water chute climaxes five years of research at Baker Dam of Puget Sound Power & Light Co near Concrete, Wash. Although complete testing of the chute was halted by flood waters last fall, results indicate it is the answer to the problem.



Arc clears dam face by 130 ft



projected from 2-ft opening

Affords Free Spill

Studies have been conducted by the power company in cooperation with the International Pacific Salmon Commission, Washington State Fisheries Department, and the U. S. Army, Corps of Engineers. They uncovered two important considerations. Fingerling salmon passing over the top of a dam must be prevented from being dashed on the spillway during the downstream passage. Otherwise, they suffer a high mortality rate. Secondly, fingerlings attain a maximum velocity in free fall and can maintain proper direction and attitude through use of their outspread fins. Experimental plantings from aircraft indicate that small fish fall like dry leaves and land with minimum shock in the water.

Fence Guides Fingerlings

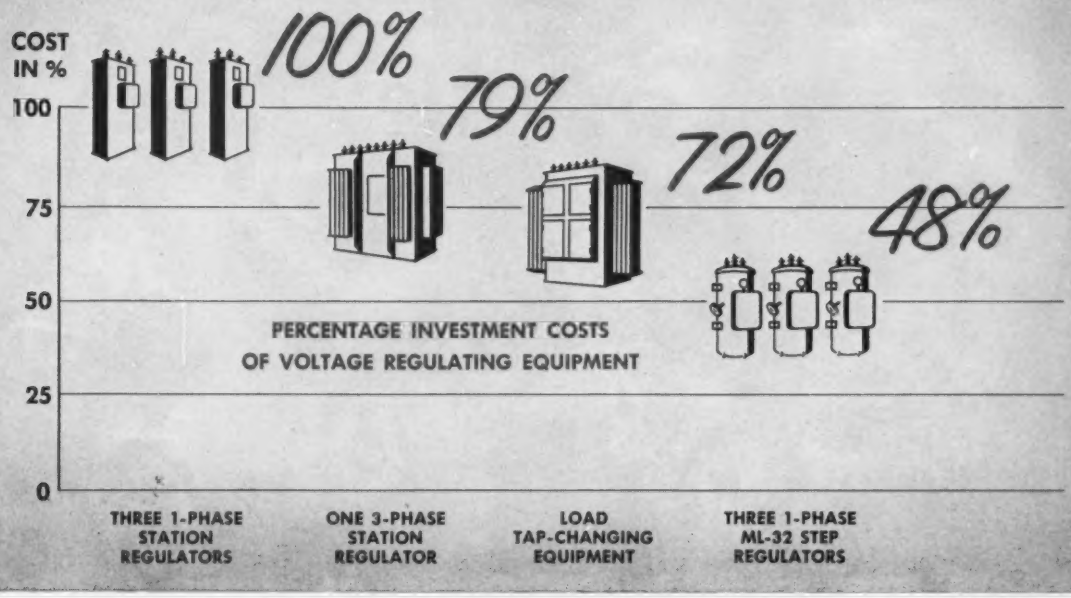
Based on these considerations, Puget Power built a chute which extends 18.5 ft from the face of the dam. It develops a trajectory which spans 130 ft beyond the face of dam for a free spill into a deep pool 250 ft below. The 10-ft wide chute is supported from below by two 8x16-in. steel I-beams set in pockets and grouted into the dam. From above, the chute is held by suspension bars. A 2-ft opening of the spillway gate usually provides sufficient water for the arc to clear the dam face.

Fingerlings are guided to the chute by an electric fence, which has proved successful at Baker Dam. The fence is designed after an experimental unit showed 99% effectiveness in tests in Canadian waters in 1954. To find out whether the fish would continue downstream from the pool after going over the chute, 1,000 young salmon were released in still water, after which water was spilled over the dam. The fish were trapped again downstream, which proved that most of them were not content to stay in the pool.

(More How To on page 98)

VOLTAGE REGULATORS

Profitable voltage regulation to help solve your distribution problems



Cost comparison shows ML-32 voltage regulators

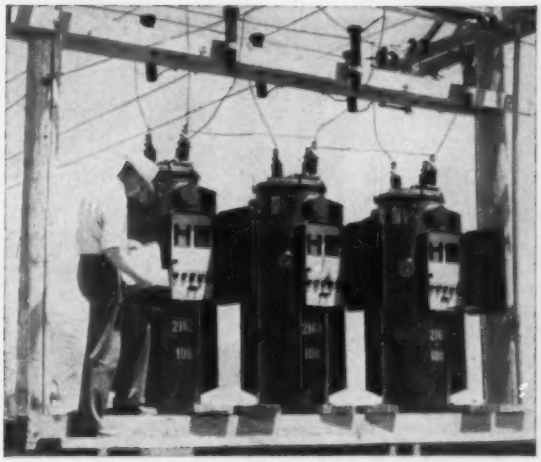
REDUCE REGULATOR INVESTMENT 50%

With new higher KVA ratings and increased current-carrying capacity now available, General Electric pole-type, single-phase Type ML-32 step voltage regulators make possible low-cost regulation in a wide range of applications, including substations as large as 8000 kva.

Compared with more expensive equipment, they can cut the cost of efficient regulation by more than 50 percent, as shown in the chart above. (This representative illustration compares the approximate relative costs of regulating a typical 3000 kva, 4 kv substation.)

Increased opportunities are thus offered to utilities not only to extend the use of voltage regulation, but also to benefit from increased revenues and savings through deferred investment in line rebuilding.

General Electric ML-32 regulators offer ±10% regulation in thirty-two 5/8% steps, in all standard voltage classes for circuits up to and including 14.4/24.9 kv. In addition, when installed on lines requiring only ±5% regulation, the G-E ML-32 step regulator will comfortably carry 160% of rated current (to a maximum of 400 amperes). For information on ratings and applications, get in touch with your local General Electric Apparatus Sales representative, or write for publication GER-1154 to Section 423-11, General Electric Company, Schenectady 5, N. Y.



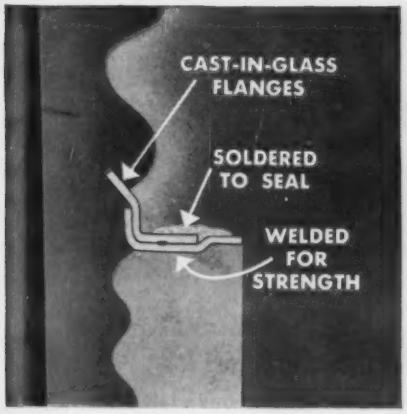
ONLY THE ML-32 REGULATOR gives you ALL the most advanced features—including Class 1 control accuracy, control dial locking, "Bounce-free" Opti-life switching for increased contact life, up to 120 seconds time delay, internal by-pass protection and many other advantages. They add up to the most efficient, economical regulator of its type available today!

Progress Is Our Most Important Product

GENERAL ELECTRIC

BUSHING STRENGTH TEST*: Here's a graphic demonstration of the ability of G-E capacitor bushings to take stresses from all directions. The upper bushing on the top capacitor withstands a sideways strain totalling the combined weight of all four capacitors—with no damage to the bushing or the seal.

* Not recommended practice.



WELDED FOR STRENGTH cast-in-glass metal flanges provide a strong, metal-to-metal bond. Soft solder is used only for assuring hermetic seal.

G-E BUSHINGS CAN'T PULL OUT: Handy lifting hook above is used as a convenient way to hoist capacitors. Tests show that bushings easily support several times capacitor weight without damage to seal.

ROUGH HANDLING is common even when capacitors are roped as above. G-E bushings can't twist out under stresses or rough handling by linemen.

Capacitors get rough handling, and G-E capacitors can take it

Unique welded and soldered bushing construction maintains hermetic seal even under lateral stress

Capacitors are constantly being hoisted onto trucks, off of trucks, and up on poles . . . and it's only natural for linemen to grab the units by their bushings. That's why G-E capacitor bushings are built to withstand stresses in all directions without damage to the hermetic seal.

This extra strength of G-E bushings stems from their unique construction. Specially made, low-expansion glass is cast to metal flanges having the same coefficient of expansion. The flanges are welded to the capacitor case for mechanical strength, and soldered for a positive, air-tight, moisture-tight seal. The result is a capacitor and a bushing that are virtually the same integral part.

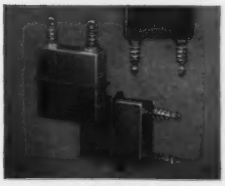
This extra strength means more than just the ability to withstand rough handling during shipment and installation. It means longer service and a permanent hermetic seal in spite of all-directional stresses due to temperature and humidity variations. Hermetic sealing means that the impregnant stays in and air and moisture stay out of the capacitor, thus minimizing the two chief causes of expensive capacitor failures.

Write for a detailed description of "Engineered Extras" in the 16-page capacitor bulletin, GEA-6260, to the General Electric Company, Section 441-27, Schenectady 5, N. Y.

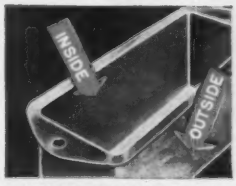
Progress Is Our Most Important Product

GENERAL ELECTRIC

ONLY G-E CAPACITORS HAVE ALL THESE Engineered Extras AT NO EXTRA COST



MOUNTED IN ANY POSITION G-E capacitors maintain uniformly high efficiency.



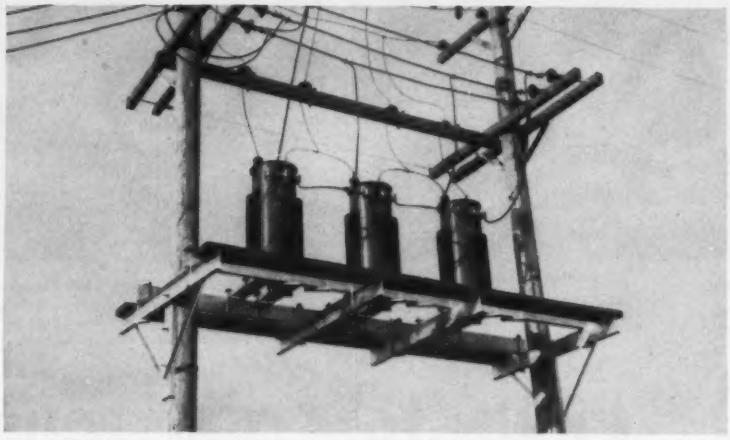
CORROSION-RESISTANT CASE, tin plated inside and outside, prolongs capacitor life.

SMALLER AND LIGHTER, than any other make, for easiest handling and installation.

NEW TERMINAL ASSEMBLY with Belleville washers gives lasting contact pressure.

Steel Cuts Two-pole, Transformer Platform Cost

GERALD F. LANG, Head, Electrical Distribution, Engineering Dept, Customers Section, Public Service Co of Colorado, Denver, Colo.



LOWER COST, higher salvage value and neater appearance mark the use of steel members for a transformer platform which will support over 10,000 lb of load

Shorter supply and increasing cost of bridge timbers prompted design of a steel platform for transformer two-pole crib structures by Public Service Co of Colorado. The steel platform offers these advantages over wood:

1. Elimination of a center support for large transformer loads.
2. Lower installation cost, higher salvage value, and neater appearance.
3. One standard design for various transformer sizes.
4. Transformers may be hoisted through the side supports of the platform.

The standard platform design has a maximum span of 14 ft. With strength enough to support more than 10,000 lb, the platform is satisfactory for three 250-kva, single-phase, 13-kv transformers of the new, lightweight type.

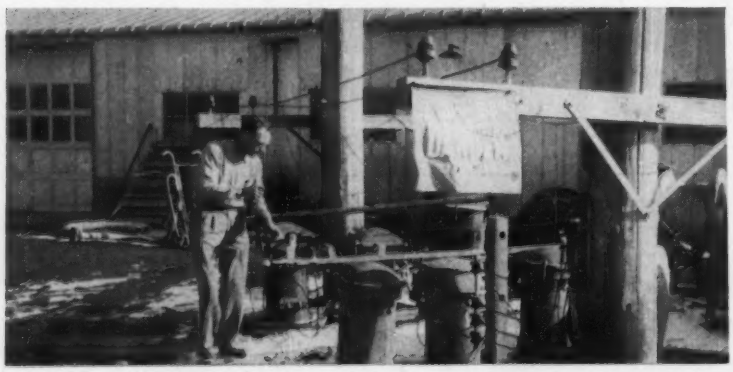
The platform consists of two channel-iron tees, welded, braced and drilled, one mounted on each pole. Two channel-iron side rails are supported on and clamped to these tees. Load is supported by two channel-iron cross members per transformer, supported and clamped to the side rails. With channel tees bolting to the poles and all other parts clamping together with U-bolts, the entire platform is adjustable in length and width.

A wood 3x12-in. walkway is furnished on each side of the platform. Guard rails, omitted for appearance sake, may be installed. All parts for the platform are fabricated locally.

All the parts are stocked as a unit, and all welding, drilling and painting are done by the steel company. Labor for installing this platform has been cut to a point where a steel platform is cheaper than an old wood platform on an installed cost basis.

Crews Train on Miniature System for Conversion Job

B. FRIDHOLM, District Operating Manager, Iowa Electric Light and Power Company



MINIATURE DISTRIBUTION SYSTEM was set up in the storeroom yard so that every lineman could fully demonstrate his understanding of the conversion procedure

When the Boone, Iowa, distribution system was cut from 2,400-v delta to 4,160-v wye, careful preparations were made, and foremen and crews were given special training for the job. A model of the system was set up in the storeroom yard.

Foremen and crews could study this miniature set-up before the conversion project started. Every lineman went through the complete procedure of converting the system from delta to wye on the miniature system. This advance training reduced the probability of mishaps during actual conversion.

(More How To on page 102)

How to figure the economy of COPPER

You can evaluate copper, very simply...by looking forward.

Not backward, to yesterday. Not inward, on the problems of today. But *forward*, to tomorrow.

For the economy of using copper is *ultimate* economy. What substitute costs less than copper . . . or gives you better value . . . whenever you can figure cost *by the year?*

The copper roof on Philadelphia's Christ Church is 200 years old. The hardware in Mount Vernon has been used since Colonial days. Copper water lines have been found in Egypt dating from 3400 B. C. And brass pipes in Boston's Parker House were originally installed in 1854.

What will people say about *your* product years after they've bought it? If you use copper, they will say what men have said through the ages: "See . . . it pays to buy *quality!*"

When the reputation of your product is involved, make it with copper! Copper & Brass Research Association, 420 Lexington Avenue, New York 17, New York.

COPPER & BRASS
RESEARCH ASSOCIATION

. . . AN INDUSTRY SOURCE OF TECHNOLOGICAL AID, INCLUDING A LIBRARY OF TECHNICAL LITERATURE AND A COUNCIL OF SPECIALISTS

COPPER OR ITS ALLOYS PROVIDE THESE ADVANTAGES:

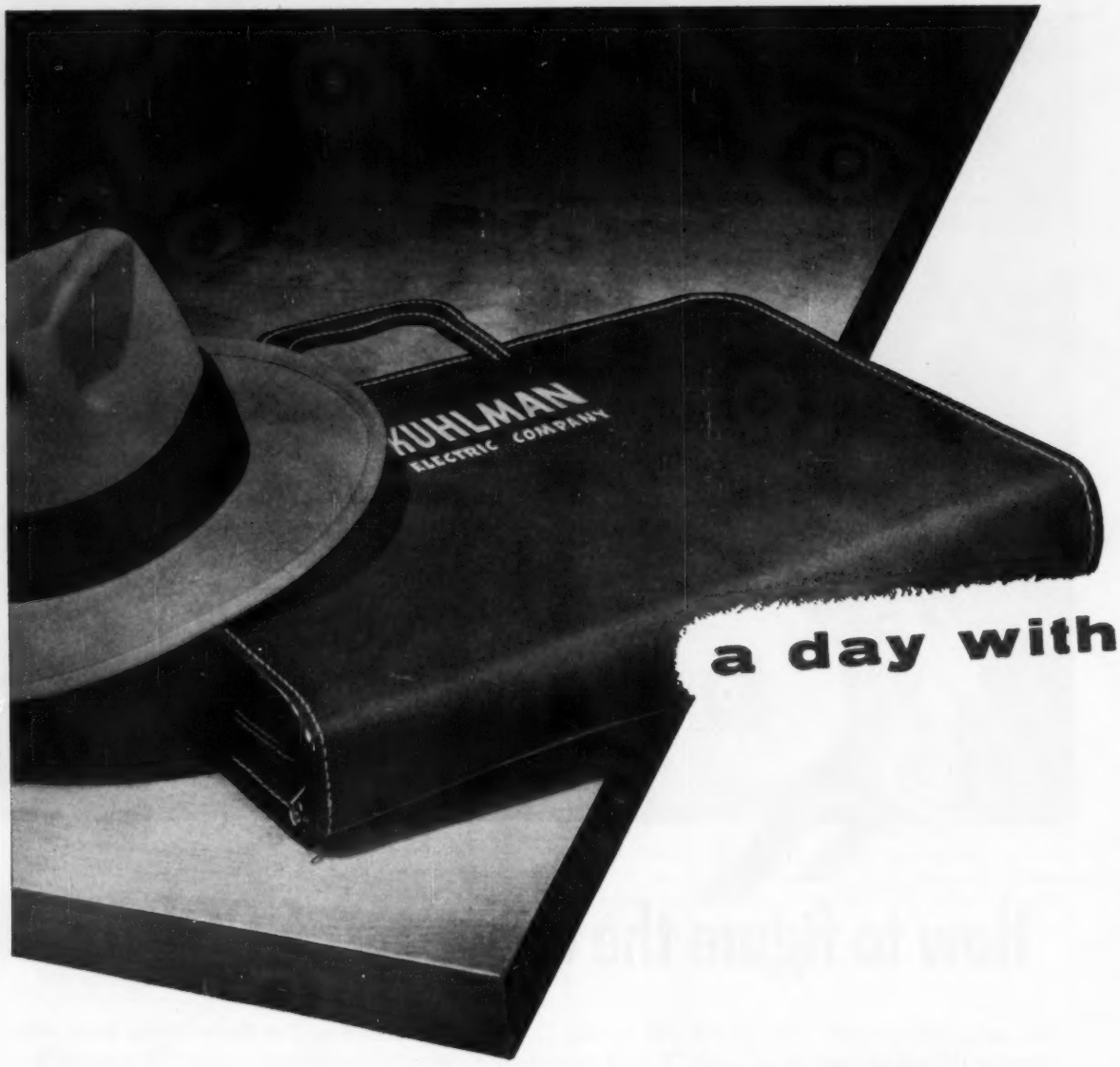
Best conductor of electricity commercially available

Does not rust . . . High corrosion resistance

Best heat transfer agent of all commercial metals

Easy to machine, form, draw, stamp, polish, plate, etc.

Welds readily . . . excellent for soldering and brazing



a day with

. . . makes YOUR day more profitable

You stand to benefit several significant ways by the visits of your friendly Kuhlman representative. He brings you the experience of both a highly skilled technician and a successful businessman. He capably represents his company—a pioneering organization that has specialized in manufacturing top-quality transformers for more than 60 years.

His company is small enough to get answers fast by avoiding red tape and inter-departmental tie-ups. Yet, his organization is large enough to get you the right answers, having been repeatedly recognized by the industry for its outstanding contributions in design and performance.

He represents a national network of 51 Kuhlman sales and service offices, 23 regional warehouses, and 3 conveniently located factories anxious to serve you immediately —whenever and wherever the need arises. In your behalf, he has immediate access to all headquarters personnel. Your Kuhlman representative can become an important additional man on your staff . . . to make your job easier—your days more profitable.

finding the facts—*firsthand*

Your Kuhlman representative likes to look at your problems—firsthand. He'll ask permission to inspect your facilities out on-the-job even though it takes extra time and effort. He knows that field checking assures straight thinking about your particular transformer problems. You'll find your Kuhlman representative coming up with practical, specific ideas that will save money and improve service like no amount of desk-top talk can ever do.

your KUHLMAN representative

enlarging your staff—*with specialized skills*

Your Kuhlman representative is a successful businessman in his own right. His business judgement is highly valued by his clients and at his parent company. Both his business skill and his technical knowledge can mean money to your organization. Many of his customers look on him as an additional, important man on their staffs. You, too, can use his skills . . . they are at your service whenever you desire.

getting headquarter's help—*in a hurry*

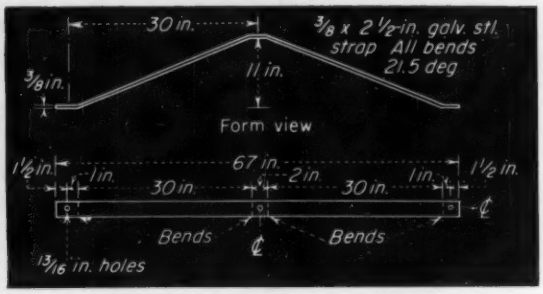
Your Kuhlman representative has direct access to the top personnel at headquarters when working on your problems. Without delay, his request sends our top engineering, research and production personnel to work on your problem—right now. With problems and with planning, your Kuhlman representative can be a source of up-to-the-minute ideas . . . a check against current practices in the field . . . a reliable source of product information.

KUHLMAN
ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

TRANSMISSION—Construction

Special Brace Reduces Deadend Cost $40



STEEL STRAP back brace transfers strain from single arm to pole. Both guying of arms and guy stub are eliminated

NEAT APPEARANCE and less congestion marks the use of steel back brace on deadends for 4 or 12-kv urban circuit

JOHN W. CROMER, Distribution Engineer
JAMES S. KREITZBERG, Design Engineer,
Montana Power Co, Butte, Mont.

Special steel brace and deadend crossarm have cut the cost and improved the appearance of deadend installations for Montana Power Co.

Designed primarily for 4 and 12-kv urban lines, the combination not only saves about $40 over the previous construction but may be built in less time. These deadend installations are designed for 400-MCM, all-aluminum conductor with a maximum of 2,000 lb tension in the phase conductors and 1,000 lb for the neutral, 3/0, all-aluminum conductor.

The new installation is designed around a hot-dipped galvanized steel strap back brace. Shape and dimensions of this brace are shown in the accompanying drawing. The brace transfers the strain from the crossarm to the pole. It eliminates the need for crossarm guys and a guy stub pole. Only the deadend pole, and not the crossarm, requires guying.

Key unit in transferring the strain from the arm through the brace to the pole is a 4-in. Teco shear plate. This plate is installed between the brace and crossarm in a special countersunk hole and groove pre-drilled in the arm. The brace and crossarm are joined with a ¾x6-in. galvanized machine bolt. This method of attachment prevents the bolt from tearing through the arm. The brace and arm are attached to the pole with a ¾x16-in. double-arming machine bolt.

In choosing crossarms for these deadend installations, special attention must be paid to insure getting arms of high quality. Arms are 8 ft. long and measure 4¾x3¾ in. Except for 14 in. along the center of the arm, both top edges are chamfered to permit conductors to be pulled over the arm more easily and without damage.

First step in the installation is to attach the arm with the double-arming bolt and a metal pole gain next to the pole. Nuts are turned onto the bolt, and the arm is tightened to the pole. Another nut is put on the bolt before the brace is attached. This nut is backed off to give an 11-in. separation between the ends and the center of the brace. This flexibility accommodates different pole diameters. Then another nut is used to tighten the brace on the bolt.

Cost of the former method of deadending using guyed double-arms and a guy stub was $106 installed. By use of the special brace, this cost has been cut to $64.

SUBSTATION Maintenance

'Snakes' Scare Birds Away from Substation Structures

Five "snakes" draped realistically about the substation steel at Tontogany substation of the Toledo Edison Co have proved effective in repelling birds. The birds are not interested in lighting or nesting near the "snakes" which were made of old line hose, painted yellow and black.

At the McLean substation a gelatinous material was squirted on the birds' potential landing places, giving the birds the impression that they had lighted on a bowlful of jelly. A commercial preparation, the substance can be painted or squirted on the steel or ledges, remains effective for long periods, and is not washed off by rain. At the Dixie substation shotgun shells filled with fine rock salt discouraged large flocks of starlings and sparrows.

(More How To on page 108)

HERE'S ANOTHER WAY...

Preformed Guy-Grips CUT GUYING COSTS!

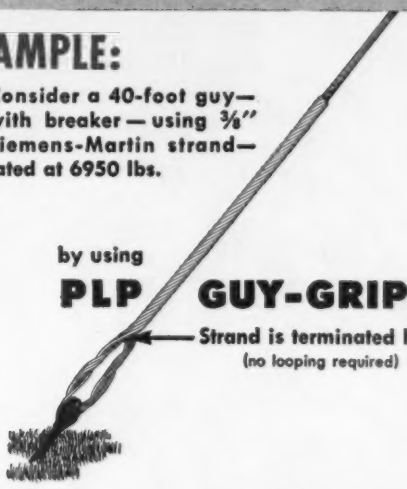
EXAMPLE:

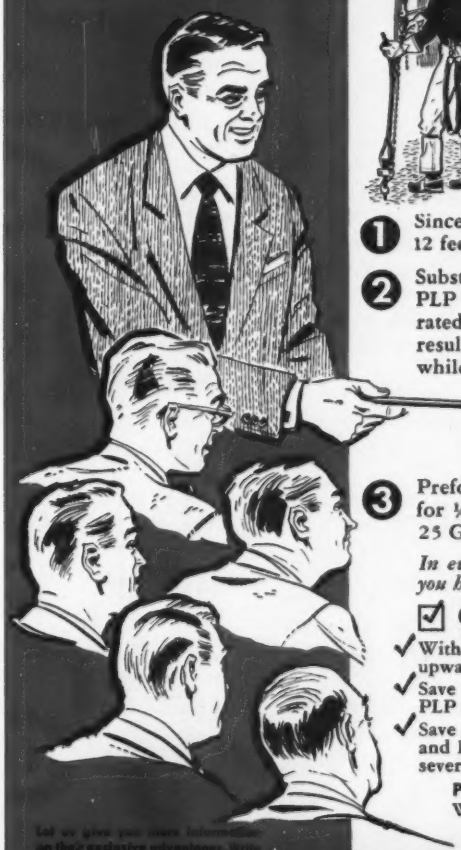
Consider a 40-foot guy—with breaker—using 3/8" Siemens-Martin strand—rated at 6950 lbs.

by using

PLP GUY-GRIPS

Strand is terminated here
(no looping required)





1 Since PLP Guy-Grips eliminate looping, strand saving of 12 feet or more per guy results. **SAVING: $.67 per guy**

2 Substitute ¼" Extra High Strength Strand — rated 6650 lbs. PLP Guy-Grips make this possible since they hold the full rated strength of E.H.S. Strand. The following strand savings result (current cost of ⅜" galvanized strand is $2.24 per guy while ¼" E.H.S. costs $1.36 per guy)*: **SAVING: $.88 per guy**

TOTAL STRAND SAVING ALONE: $1.55 per guy

3 Preformed Guy-Grips cost only $.55 each for ¼" E.H.S. Strand size. (PLP Cat. No. 25 GDE-¼")

Compare this cost with your current fitting.

PLUS LABOR SAVINGS

In every Preformed Guy-Grip installation, you hold the full strength of the strand.

☑ CHECK THESE ADDITIONAL SAVINGS:

- ✓ With PLP Guy-Grips, leading utilities estimate installation savings upward of 50%.
- ✓ Save an additional 10% by using 3-wire strand instead of 7-wire. PLP Guy-Grips will hold 3-wire strand equally well.
- ✓ Save space and inventory costs by standardizing on PLP Guy-Grips and lighter E.H.S. Strands. One size strand can be substituted for several sizes and grades previously used.

PLP GUY-GRIPS ARE ALSO AVAILABLE IN COPPER-WELD, BRONZE, AND STAINLESS STEEL.

**Based on current strand prices—75,000 feet to carload lots.*

Let us give you more information on their exclusive advantages. Write us or call Preformed Line Products Company: Call EXpress 1-3571.

PLP GUY-GRIPS DON'T SLIP . . . even under impact!

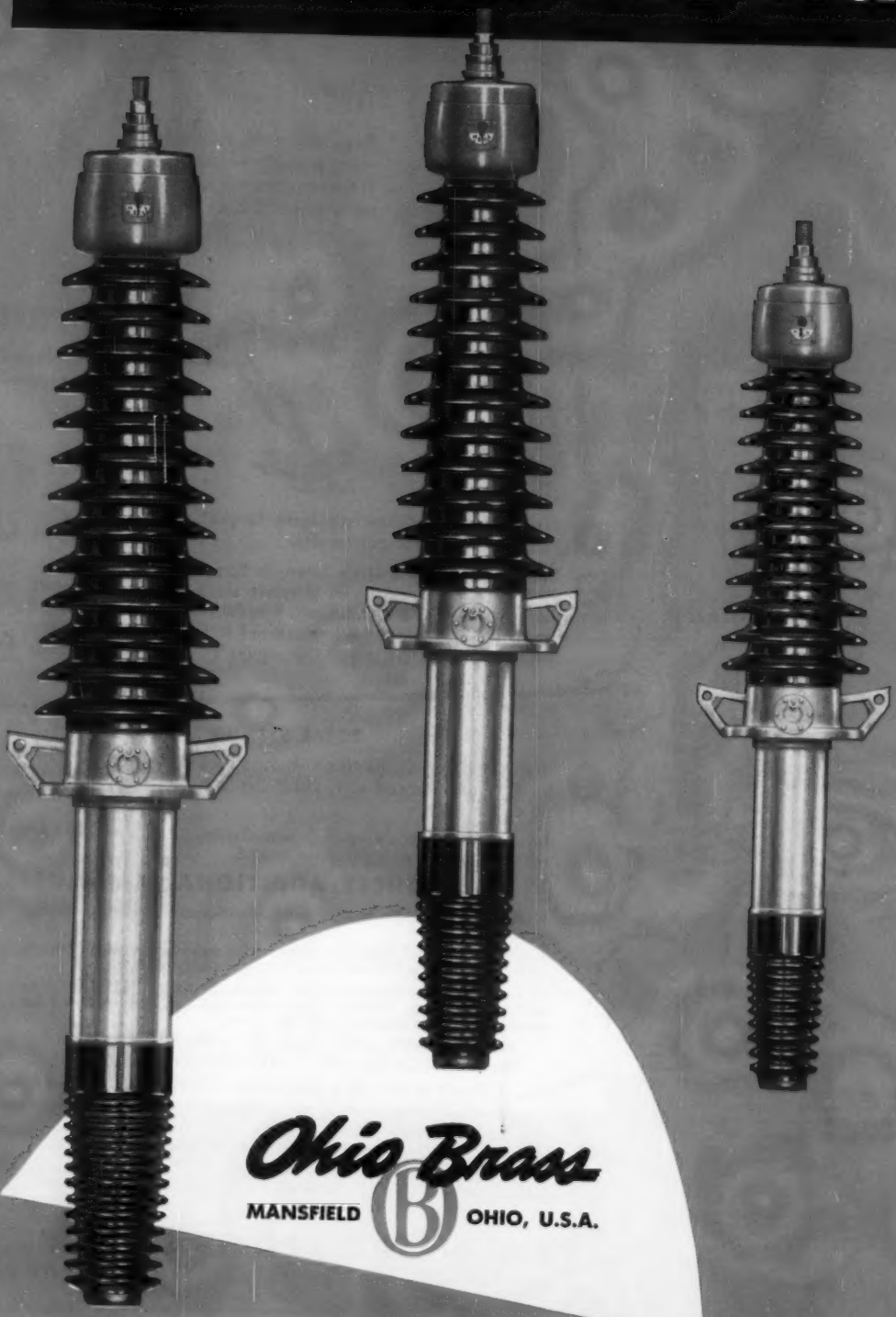
Made in accordance with or for use under one or more of the following U.S. Patents: 2,275,019; 2,387,521; 2,609,633; 2,691,865; other patents pending.

PLP

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 2, OHIO

Now...All the Way



Ohio Brass

MANSFIELD OHIO, U.S.A.

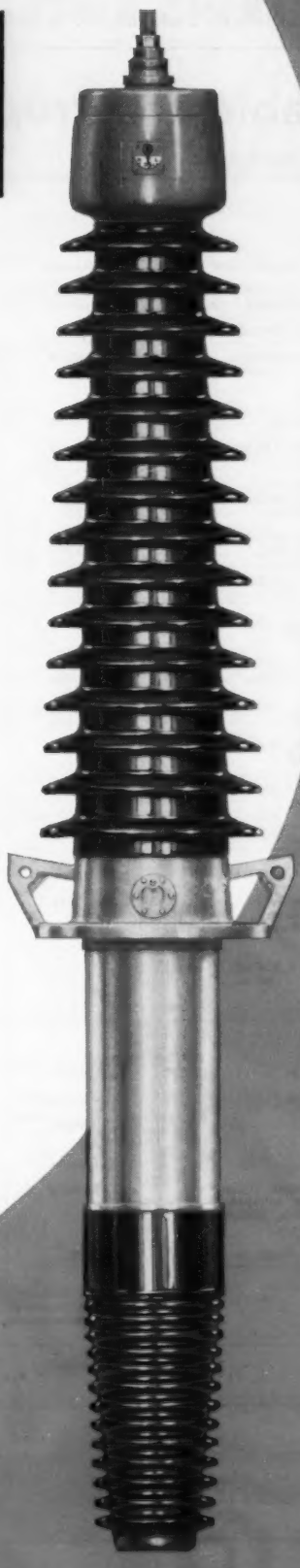
to 230 kv

With New Small-Diameter O-B Bushings

O-B has now completed its range of small-diameter, lightweight apparatus bushings to include 230-kv operating voltage. A few quick facts about these new bushings are --

1. In this higher range (69 to 230 kv), the insulating core is surrounded with oil from end to end.
2. This core utilizes full condenser construction, comprised of multiple layers of foil and paper.
3. O-B's long-established principle of spring compression assembly, combined with improved gasketing practices, assures the vital function of permanently tight sealing.
4. In the 115 to 230-kv range, all bushings are equipped with oil level gauges and capacitance taps.
5. National Standards for these voltages have not yet been formulated, but the present O-B design is fully in line with up-to-date trends.
6. These new models extend upward in rating from the present ASA Standard series covering 23 to 69 kv. There is now an O-B bushing available for all popular operating voltages, embodying modern dimensional requirements.

One more fact -- of prime importance. For nearly 50 years, O-B has manufactured bushings that have earned the reputation for being the best of their times. This has provided priceless experience and background when embarking on the design of the new O-B bushing -- a worthy member of an illustrious family.



4639-H

Table IV—Properties of Laminated Sheets

Data Supplied by Manufacturers

DESCRIPTION		DILECTO					FORMICA
Trade Name							
Type of Plastic for Classification		Phenolic	Melamine	Silicone	Teflon	Polyester	Epoxy
Filler: (F)abric, (P)aper (W)ood, (N)ot any		Nylon F	Glass F	Glass F	Glass F	Glass Mat	Glass F
(M)olded, (L)aminated, (E)xtruded, (C)ast		L	L	L	L	L	L
Manufacturer's Grade or Number		MEC-5	GB-28M	GB-112S	GB-112T	GM-PE	FF-91
Electrical Properties	ASTM Method						
Volume Resistivity, ohm-cm	D257	$>10^{12}$	8×10^{11}	$>10^{12}$	$>10^{12}$	$>10^{12}$	.....
Dielectric Strength, vpm, ⅛ in. thickness, short time test	D149	450	275	350	300	160	550
Dielectric Constant, 60 cps	D150	3.8	7.4	3.75	2.85	4.80	.....
10^3 cps	D150	3.7	7.0	3.75	2.85	.....	.....
10^6 cps	D150	3.6	6.6	3.75	2.85	4.50	5.3
Power factor, 60 cps	D150	0.013	0.008	0.0005	0.0005	0.016	.....
10^3 cps	D150	0.013	0.007	0.0009	0.0004	.....	.....
10^6 cps	D150	0.014	0.014	0.0015	0.0006	0.017	0.024
Arc Resistance, sec	D495	5	185	250	200	150	130
Mechanical Properties							
Specific Gravity	D792	1.15	1.90	1.68	2.20	1.80	1.73
Tensile Strength, psi: (s)tandard or (d)ry (approx 73F)	D638	8,500	37,000	23,000	23,000	24,000	44,000
Compressive Strength, psi	D695	30,000	75,000	45,000	20,000	48,000	50,000
Impact Strength, ft-lb/in; ½ x ½-in. notched bar, Izod Test	D256	3.5	10.0	9.0	6.5	16.0	10
Hardness, Rockwell	D785	M105	M120	M100	M60	M100	M110
Shore	D676	.....	.....	.....	.....	.....	.....
Machining Qualities	.....	Excellent	Fair, Hard on tools	Fair to Good, Hard on tools	Good, Punching & machining	Good, Punching & machining	Good, Abrasive on tools
Thermal Properties							
Safe Operating Temperature, F	.....	1651	300	400	500	275	.....
Flammability: (N)onflammable	D635	S	S	S	.....	S	S
(S)elf-extinguishing, or burning rate	D757	.....	.....	.....	Vaporizes	.....	0.8 in./min
Heat distortion, @ deg F, 264 psi	D648	.....	.....	.....	.....	360–400	365
66 psi	.....	.....	.....	.....	.....	.....	.....
Brittle temperature, F	D746	.....	400	500	.....	.....	.....
Chemical Properties							
Water Absorption, 24 hr, %	D570	0.17	1.2	0.2	0.02	0.4	0.35 MAX
Resistance to Weathering	D795	Not recommended	.....	.....	.....	.....	.....
Basic Color	.....	Natural	Natural	Natural	Natural	Natural	Natural
Light Transmission	.....	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque
Resistant to: (w)ater, (a)cids, al(k)alies, (s)olvents, organic sol(v)ents, o(x)idizing compounds, (d)ilute acids, (h)ydro carbons	.....	W, D, V	W, D, K & V	W, D	W, A, K S, V, X	W, D, V	W, S, V
Not resistant to (list as above)	.....	K	A	V, K	None	K	K
Uses	.....	Electrical insulation, For high insulation and fungus resistance	High arc and Flame resistance	Low dielectric loss & Moisture resistant insulation	Low dielectric loss & Moisture resistant insulation	Good electric insulation, High impact & flexural	.....
Manufacturers	.....	Continental-Diamond Fibre Div. of The Budd Co, Inc					Formica Co

Final in a series of four tables covering properties of typical plastics used primarily for electrical insulation.

Table 1—Properties of Plastic Insulations without Fillers: Part 1 was published in Electrical World, Oct. 17, 1955, pp 160-161; Part 2, Oct. 31, 1955, p. 88.

Table 2—Properties of Plastic Insulations with Fillers:

Not Covered by ASTM-NEMA Grades

TEXTOLITE		BENELEX	INSUROK	SYNTHANE				TEMPREG
Melamine	Melamine Epoxy Binder	Ligno-Cellulosic	Polyester	Melamine	Phenolic	Diallyl Phthalate	Epoxy	Phenol
P	Glass Cloth	.....	Glass F	P	P	Glass	Glass	P
L	L	Sheet	L	L	L	L	L	L
11,532	11,546	.....	XT-200	XXM	XXXP-1R	G-104	G-10	A
.....	.....	.....	.....	.....	2×10^{13}	10^{7}	10^{7}	.....
580	680	190	500	360	470	600	500	460
.....	.....	8	.....	7.0	4.5	4.5	4.5	.....
7.9	4.8	.....	3.06	7.0	4.6	5.3	5.3	6.02
.....	.....	12	.....	0.07	0.025	0.010	0.010	.....
0.063	0.020	.....	0.017	0.05	0.030	0.024	0.024	0.044
.....	.....	.....	125	120	.....	120	120	.....
1.49	1.77	1.4	1.61	1.40	1.30	1.80	1.90	1.37–1.39
16,800	37,400	8,000	14,500	16,000	12,400	40,000	40,000	28,000
.....	82,000	26,500	26,000	34,000	25,000	60,000	60,000	19,000
.....	16+	0.6	13.0	1.0	0.30	9.0	9.0	3.0
M117	.....	M90	.....	M112	M105	M110	M110	.....
Good	Excellent	.....	Good	Excellent	Excellent	Excellent	Excellent	Excellent
250	300	.....	300	260	250	325	325	200
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	Thin lamination slow
1.6	0.15	1.0	0.7	1.95	0.5	0.5	0.25	0.75
.....	.....	.....	.....	Excellent	Good	Excellent	.....	Good
Natural	Natural	Dark brown	Natural white	Grayish brown	Natural var. tan	Natural greenish white	.....	Tan
.....	.....	.....	.....	.....	.....	.....	.....	Opaque
.....	.....	W, S, V good, A, X fair	.....	.....	Fair A, K, S, V; Excellent W	W	W	W, A, S, V
.....	.....	K	.....	.....	.....	.....	.....	K, X
Arc resistant insulation	Electric insulation, For high insulation resistance & Low water absorption	Panel boards, Separators, Spacers, Housings	Switches, Motors, Transformers, Control devices	Terminal boards, Switch, stators & rotors	Electronic, Radio & TV devices	Terminal boards, Switch stators & rotors	Low moisture absorption	Spacers, Precision thickness & dimensional stable
General Electric Co		Masonite Corp	Richardson Co	Synthane Co				U. S. Plywood Corp

Part 1 was published Nov. 14, 1955, p. 158; Part 2, Nov. 28, 1955, p. 98.

Table 3—Properties of ASTM-NEMA Grades of Laminated Thermosetting Sheets was published Jan. 23, p 198.

Compiled for use in Electrical World and subsequent editions of Standard Handbook for Electrical Engineers.

TRANSMISSION—Maintenance

Washing Rig Has 2-Man Movable Platform

Delivers a 600-psi water spray and has a 1,000-gal water tank, all mounted on 10-ton truck

Washing insulators on high lines is facilitated through the use of a second washing rig put into service by San Diego Gas & Electric Co. The new unit has a hydraulic boom with a two-man working platform, delivers a 600-psi water spray, and has a 1,000-gal water tank.

The boom is mounted on a three-axle, ten-wheel truck powered by a 180-hp engine providing ten forward and two reverse speeds. Overall dimensions are: Length, 33 ft; weight, 42,000 lb, including 1,000 gal of water; height with boom in lowered position, 13 ft, 4 in. The platform can be raised to 54.5 ft above ground.

Controlled from Cage

Located to the rear of the back wheels, the hydraulic boom can be extended to the full height in a few minutes. All movements of the boom are controlled from the cage through foot pedals so that the operator has full use of his hands in directing the spray hose. Secondary controls are in the cab. Hydraulic stiff legs at the truck's rear provide stability on uneven ground.

Water pressure of 600 psi is provided by a 55-gpm pump driven by a 30-hp gasoline engine, both of which units are mounted behind the cab. Next to these is the 1,000-gal tank holding enough water for an average day of washing. A rear compartment houses water meters and a manifold system for refilling the water tank in the field. Material and equipment may be stored in side compartments of the truck.

While the operator is aloft in the cage, the driver is in the cab. He can assume control of the boom through the secondary controls. In the event of complete hydraulic power failure, a manual emergency control system lowers the boom to the ground. Work signals are exchanged between operator and driver over a buzzer system. Consideration has been given to replacing the buzzer system with a telephone line in the future.

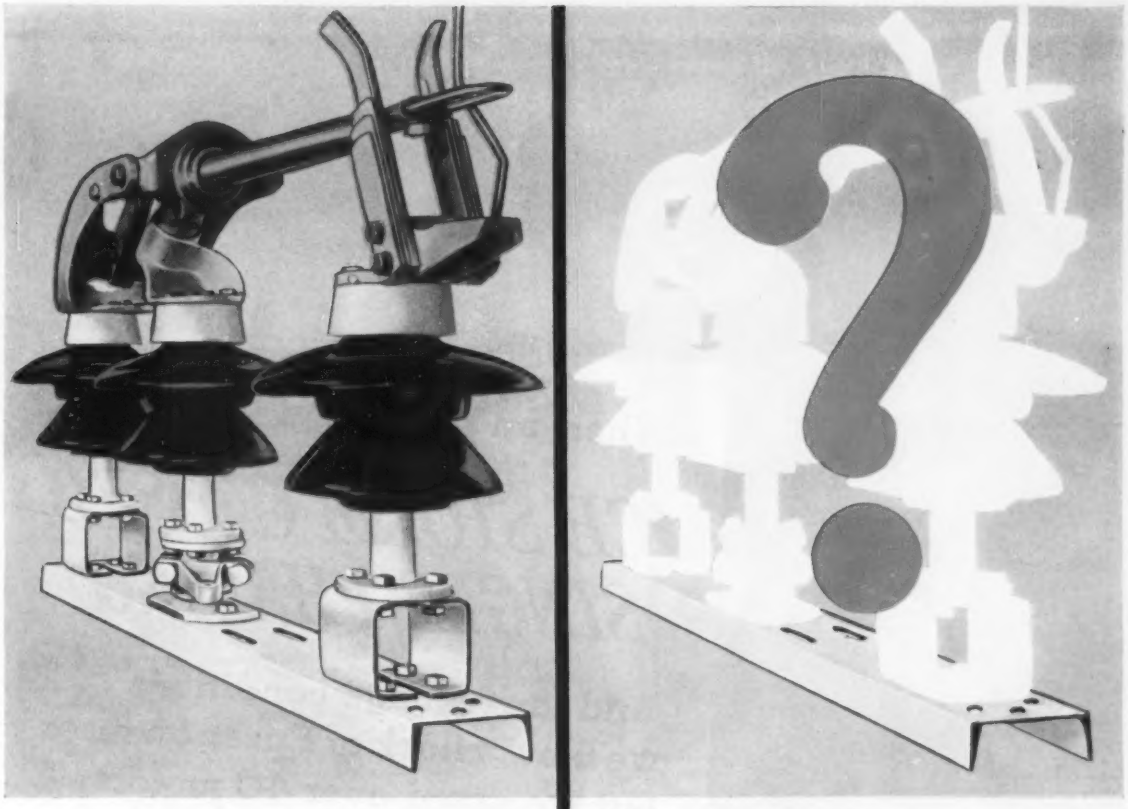
TWO-MAN PLATFORM can be raised 54.5 ft above ground. Duplicate boom controls in cab allow driver to control. Signals exchanged over a buzzer system

SUBSTATION—Design

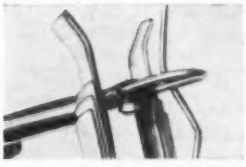
Connect Potential Transformers to 138-Kv Bus

Carrier distance relaying is used on the Central Power & Light Co system where potential transformers are tied directly to the 138-kv bus with no fuses. Dependence is placed on the reliability of the modern potential transformer. When fuses are used their purpose is to take a faulty transformer off the bus, not to protect it. When a transformer fails now it operates the bus differential relays and removes the circuit from service. This usually happened, even when transformers were fused.

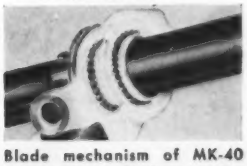
(More How To on page 112)



Original or 'similar'—which do you prefer?



Delta-Star MK-40 Switches feature maximum contact efficiency and safety, with minimum current interchange surfaces.



Blade mechanism of MK-40 Switches has only three moving parts, yet develops enormous rotating operating leverage.

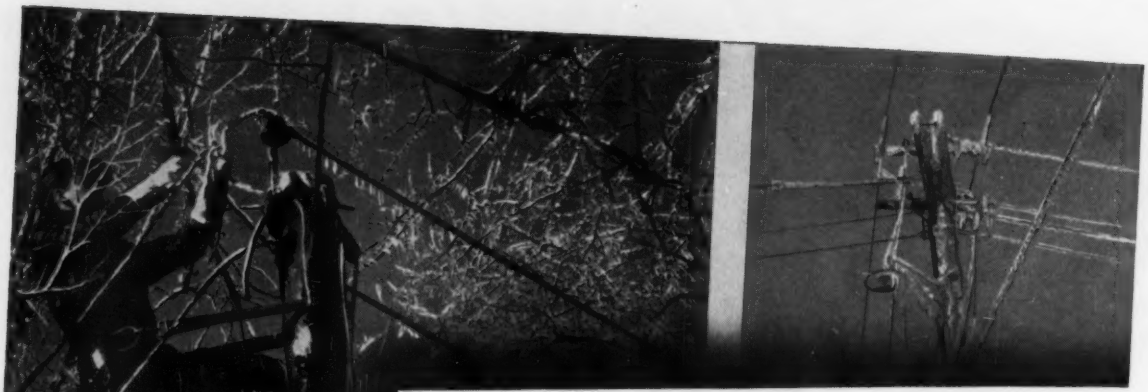
When you consider high voltage switches, one stands out because of its original performance-proved features that seem to be appearing in other switches. The standout is Delta-Star's MK-40.

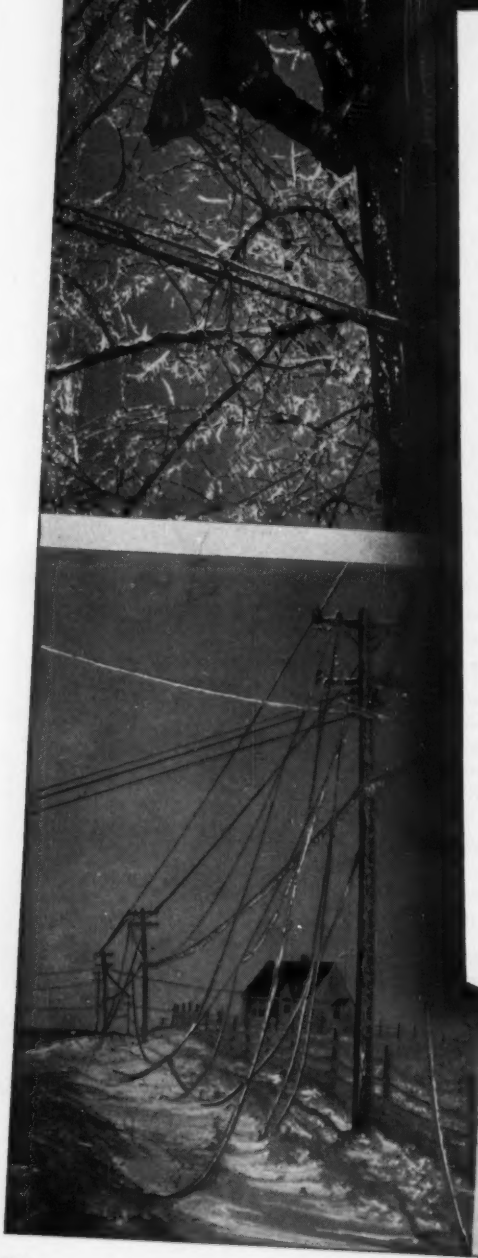
Appearance to the contrary, *Delta-Star MK-40 Switches alone offer a combination of unequalled advantages originated by Delta-Star.* They feature sturdiest possible construction and large, rugged sealed-type ball bearing blade actuating mechanism for assured long service. They have a minimum number of moving parts and minimum current interchange surfaces—for efficiency and ease of operation. Contact pressure-applying springs carry no current, and offer large deflection to maintain uniform high pressure contact over extended periods of use. The fully controlled blade has high pressure silver-to-copper contacts at both ends. Contacts are fully visible for inspection.

Similarities help prove the exceptional value of the original. That certainly applies to Delta-Star MK-40 Switches—in all ratings—400 to 5000 amperes and 7.5 to 380 kv. Keep the MK-40 as your standard of comparison.

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
2437 Fulton Street • Chicago 12, Illinois
District Offices in Principal Cities





When an

ICE STORM CAUSED SINGLE PHASING

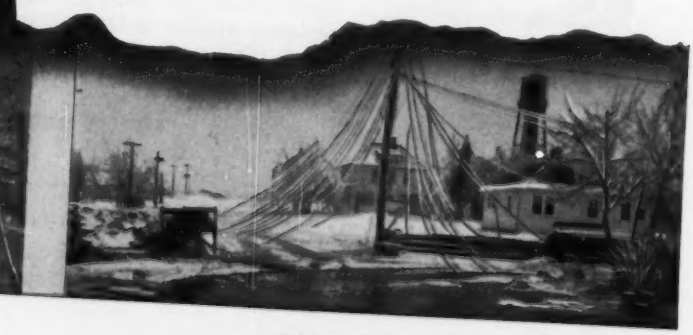
and low voltage conditions . . we blew a flock of Fusetron fuses but we saved over 40 motors from burnout

"For twenty-four hours after the bad ice storm of February 15, 1950 we were endangered by single phasing and low voltage conditions due to the damage done the power lines by the ice.

"During this period, we blew a flock of Fusetron dual-element fuses—around 240 in fact—but we figure that was a very cheap price to pay for saving over 40 motors from burning up.

"After this experience we didn't lose any time in putting all of our plant and equipment under Fusetron Fuse protection."

Michael G. Kupcho,
Master Mechanic
Ashland Shirt and Pajama Company
Ashland, Pennsylvania



You too, can be safe from electrical hazards by using

Fusetron DUAL ELEMENT Fuses

They provide 10 Point Protection

1 High interrupting capacity—protect against heaviest short-circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

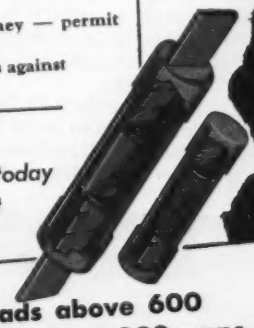
Write for bulletin FIS.

DON'T RISK LOSSES — *Start today to install FUSETRON fuses throughout the entire electrical system!*

It migh
were op

Mutual Rehek

"Obtainin
will not smea
when some on
cement on th
Hotcoater t



FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

256

For loads above 600 and up to 5,000 amps., . . . use BUSS Hi-Cap Fuses . . .

They have unlimited interrupting capacity to handle any fault current regardless of system growth.

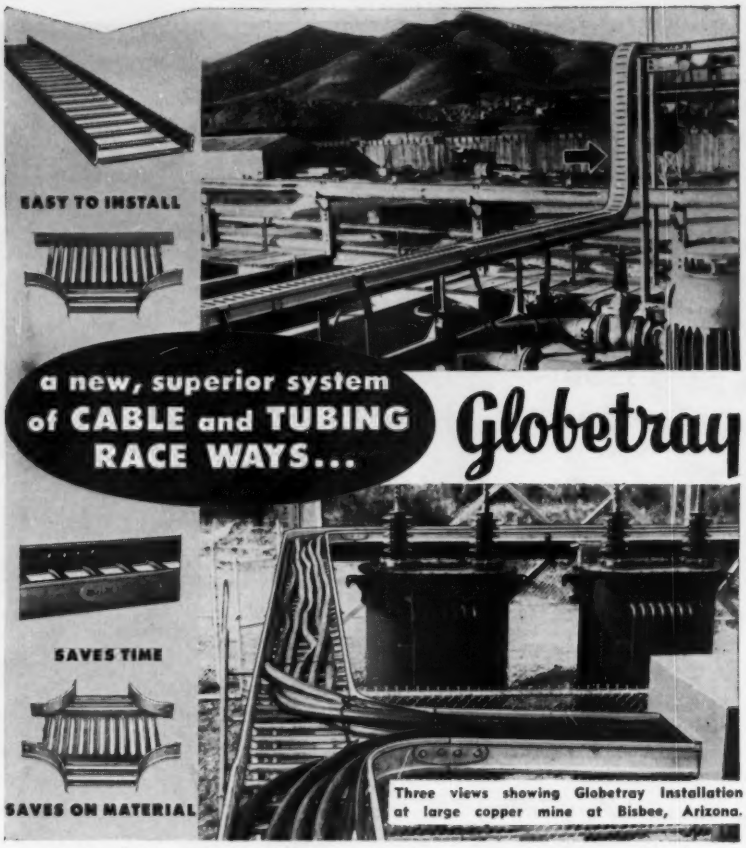
Overload protection as well as short-circuit protection.

Coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuits of origin.

Dependable service through the years because there are no moving parts to stick or get out of order.

Write for bulletin HCS.

BUSSMANN MFG. CO. (Div. of McGraw Electric Co.) St. Louis 7, Mo.



A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point – insides and bottom always smooth – all sections punched for easy installation – perfect fit at all times. Neat, clean and uniform in appearance.

Write for new complete catalog. Distributors in all principal cities. Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.

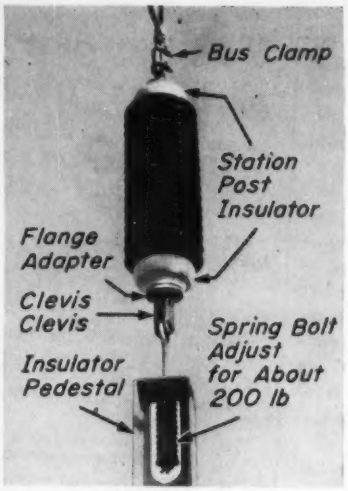
Manufacturers Since 1914 **The GLOBE Company**

4030 S. PRINCETON AVE. • CHICAGO 9, ILL.

SUBSTATION—Construction

Vertical Bus Anchored By Steel Channel Unit

A vertical substation bus on the Central Power & Light Co system is anchored simply by means of a vertical steel channel member with a closed end and a suitable point of attachment.



A spring, maintaining tension, prevents the bus from vibrating in the wind. Rigid design is avoided to allow for movement of the foundation and the different expansions of copper and steel.

The vertical bus was installed at a switching center on the 138-kv system some 30 miles from San Antonio, Texas, where atmospheric contamination prompted many design features.

DISTRIBUTION—Maintenance

Device Shows Ground on Series Street Lights

L. K. HUMPHREYS, City Engineer, Hiawatha, Kan.

A lightly fused artificially created ground forecasts for municipal work crews the location of a leak to ground anywhere on Hiawatha's underground series street lighting system.

This town has many miles of underground cable buried back of the

(Continued on page 114)

Have you seen the NEW Chance Side Break Switches?

Desk-top model demonstrates features that make this high-pressure contact switch easy to install, easy to operate, and able to withstand extremely high fault currents.

TOM CURTIS, Chief Switchgear Engineer, and CHUCK LIMING, Switch Sales Manager, discuss features of quarter scale demonstration model of new Chance Type S Switch.

The Chance Type S Side Break Switch has everything that utility engineers have asked for in a ruggedly-built, economical switch for sectionalizing, disconnecting, by-passing and isolating applications. It was designed to combine ease of installation and operation with the high mechanical strength and thermal capacity necessary to withstand, without damage, the extremely high fault currents possible on today's systems. It passes every test.

If you haven't seen it, a letter, post card, or phone call will bring a Chance representative with a desk top demonstration to show you how this Chance Switch has the simplicity of installation, ease of operation and freedom from costly maintenance that you've looked for in the switches you buy.

High pressure, self-wiping silver to copper contacts.

Sealed high pressure, silver to silver permanently lubricated hinge contacts.

Braidless current path. Sealed high pressure, silver to silver permanently lubricated hinge contacts.

Independently bolted auxiliary crank can be adjusted to within 2½° of any desired position.

Sealed, greaseless ball bearings of stainless steel in stainless steel races assure smooth operation.

RATINGS

400 Ampere—7.5 KV through 34.5 KV
600 Ampere—7.5 KV through 69 KV
1200 Ampere—7.5 KV through 69 KV

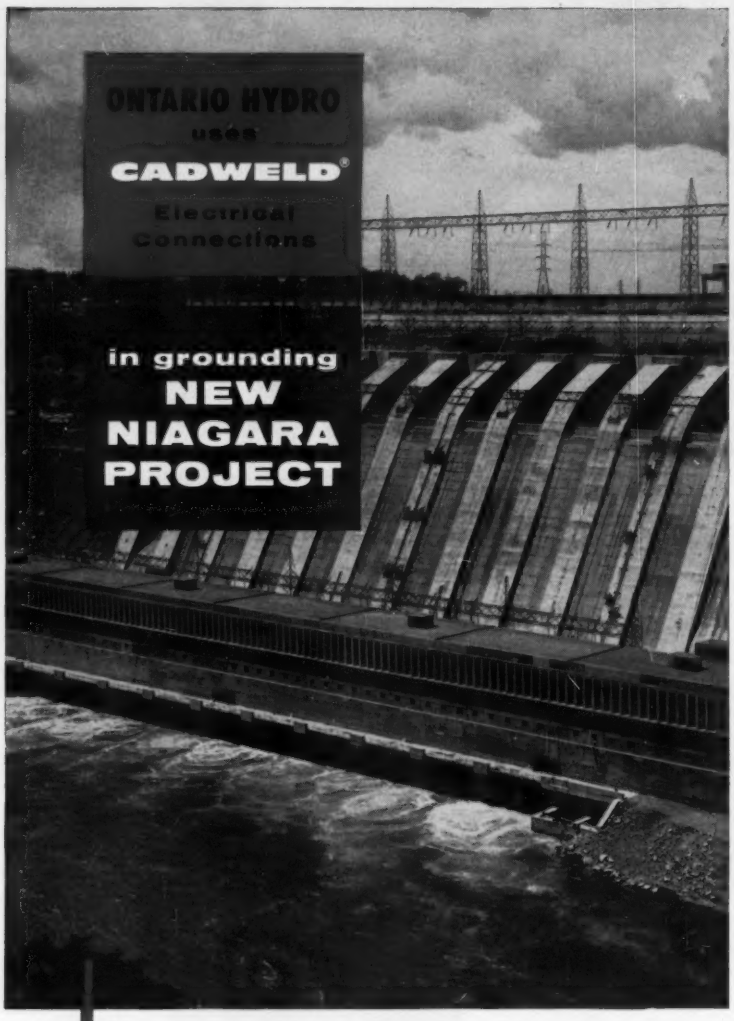
ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI

San Francisco, California • Pittsburgh, Pennsylvania

CS56-3



Illustrated is the 12-unit phase (1,200,000 horsepower) of the new SIR ADAM BECK-NIAGARA Generating Station No. 2 on the NIAGARA RIVER. The overall development will have an ultimate installed capacity of 1,828,000 horsepower. GROUNDING connections in the powerhouse and switchyard areas are CADWELD—the permanent electrical connections that cannot loosen or corrode and eliminate maintenance.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place • Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

Shows Grounds

(Continued from page 112)

curb and furnishing 6.6 amp to the series type street lighting system. In operation nearly half a century, the system has been subjected to quite a bit of maintenance.

Maintenance crews over the years have been busy running down "burn outs," as they are called locally, shorts to ground, some of them high-resistance shorts caused by weak spots in cable insulation, a poor splice, or injury to a cable attributable to other work in the vicinity. "Burn outs" causing a darkened section of the system usually occur in pairs. Normally repair of one ground permits the entire circuit to light up on the following night.

Inspection Shows Trouble

The device employed by Hiawatha for detecting faults consists of an indicating fused cutout of sufficient voltage rating but with an extremely light fuse, 1-amp, inserted. One end of fuse is attached to the circuit line and the other is well grounded. As long as there are no other grounds in the circuit, the fused ground remains unchanged. When the underground cable is damaged or a leak anywhere in the circuit becomes large enough to carry 1 amp at the operating voltage, the fuse blows and the cutout shows this fact. An early inspection of the devices each morning usually reveals any trouble about as soon as it develops.

When difficulty develops in locating trouble, a larger than ordinary fuse, for instance a 10-amp fuse, is installed in the cutout and the circuit is energized. In such circumstances the section remaining dark has one end at the fused cutout and the other at the site of the trouble. Maintenance men know then at least which light in the circuit is between the trouble and the cutout.

Often the lights in their snowball shades are difficult to see on bright sunny days, and an inspector may have to wait until night to energize the circuit. He must then be ready for work when twilight falls, and inspects the circuit soon after the street lights are turned on. When he does this before it becomes dangerously dark, he can locate the troublesome panel and make a note of its location in his report. His next procedure is to pull the 10-amp fuse switch, which removes the artificial ground, dramatically lighting

(Continued on page 115)

up the darkened section. Once the location of the "burn out" is established, the service crew can mend it at its convenience the following day.

When the work is completed and the circuit is whole, the cutout switch is again fitted with a 1-amp fuse and closed. The circuit is ready now for use as it was originally.

Hiawatha's provision affords a completely operating circuit even though one section is damaged. Furthermore, it allows the maintenance crew to catch up on the trouble before the circuit is darkened by two "burn outs." In most instances it prevents the circuit or at least part of it from being dark, as often happened before installation of the grounded fuse indicating cutout.

Other small towns with limited line help may find that this low-cost device can prevent 99% of their blackouts on buried series street light circuits.

Los Angeles Organizes 11th Lighting Bureau

Los Angeles has become the eleventh area to organize a Certified Lighting Bureau, Laurance C. Messick, manager, National Lighting Bureau, New York City, announced recently. Sponsoring organization is the Commercial and Industrial Lighting Division of the Electrical League of Los Angeles, Glen L. Logan, Managing Director.

Other areas offering Certified Lighting through electrical contractors are: Boston, Mass.; Chattanooga, Tenn.; Charlotte, N. C.; Cincinnati, Ohio; Detroit, Mich.; Providence, R. I.; Rochester, N. Y.; San Diego, Calif.; San Francisco, Calif.; Worcester, Mass.

Vepco Seeks City System

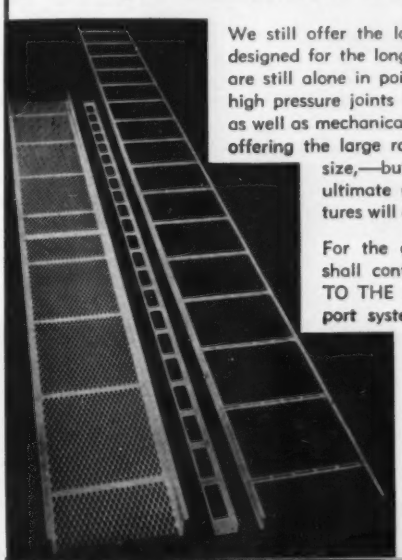
Harrisonburg (Va.) voters have been promised an unlimited supply of electrical power by Virginia Electric & Power Co if they approve on Feb 14 city council's decision to sell the municipal electric system to the utility. Other benefits cited by the utility include more revenue in the city treasury because of VEPCO's status as a taxpayer; the services of home, farm, and lighting specialists; and lower residential rates.

ALUMINUM
OR GALVANIZED STEEL
SUPPORT SYSTEMS
FOR POWER AND CONTROL CABLES
IN-FREE-AIR
DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

We are followed

We are proud to be considered the leaders in our field. We specialize in electrical cable support systems and are slowly followed by all others in:

1. The longer lengths we pioneered for field labor savings.
2. The slip-on expanded metal splices originated by us for lower erection costs.
3. The use of structurally sound racks with fully inserted and welded rungs.
4. The principle of designing for long spans to save supports.
5. The use of aluminum to reduce the "installed cost" and give a "maintenance free installation."



We still offer the longest racks, troughs and baskets designed for the longest spans and heaviest loads. We are still alone in pointing out the great importance of high pressure joints for splices to give sound electrical as well as mechanical connections and are also alone in offering the large radii fittings suitable for any cable size,—but hope that, for the benefit of the ultimate user, these and all our other features will also soon be copied.

For the convenience of our customers we shall continue to feature the "COMPLETE TO THE LAST BOLT" electrical cable support system including time-saving installation tools, will continue to help the contractors with lay-outs, take-offs and erection diagrams and will continue to excel in delivery and service rendered. "HUSKY DOESN'T COST—IT PAYS."

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.

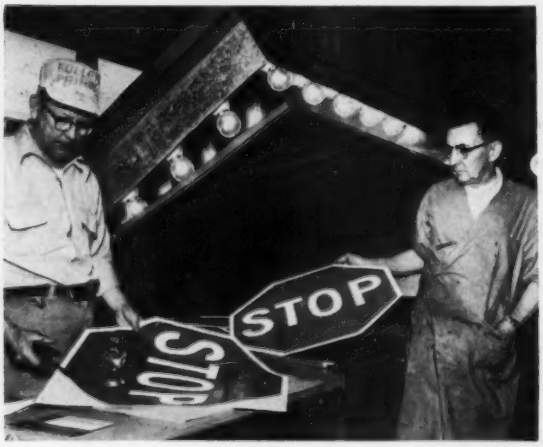
5300 VINE STREET, CINCINNATI 17, OHIO

Infrared Warms Men in Unheated Area

HARRY FISLER, Industrial Representative, Pennsylvania Power & Light Co, Harrisburg, Pa.

Men can be kept warm in unheated work areas by infrared lamps spotted at strategic points. Hildum Fermentation & Processing Co, a feed mill at Shiremanstown, Pa., now applies three 250-w bulbs about 10 ft above the bagging machine to remove the chill in that area even on days of subfreezing temperatures. Supported by a simple pull rope, the lights are adjustable up and down.

Many mills, metal fabricators, scrap dealers, and companies with loading platforms have no provision for space heating. Some use small ovens or open flame heat. These usually are inadequate and often dangerous. Moreover, employees must congregate around the source and thereby lose production time. Infrared heat is easy to apply in such cases and is a good answer to the heating problem.



Infrared Doubles Output of Highway Signs

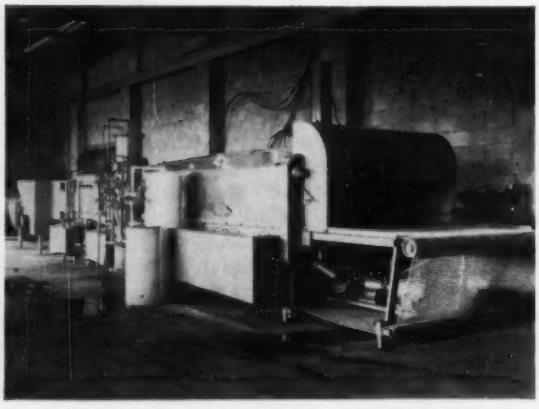
Production doubled when electric heat was applied to the manufacture of 2,000 road signs at Seattle, Wash. Manual methods were abandoned when these signs were required in a period of several weeks. A $2,400 machine that handles eight signs at a time replaced human hands on this job. A reflective sheeting bearing the sign face is laid on top of the aluminum signboard on the 4 x 6-ft bed of the machine. With all signs in place a Neoprene blanket is pulled down and air is sucked out under vacuum at 25 to 30-lb pressure. The upper part of the hinged machine contains 35 375-w heat lamps which are turned on after the lid is closed. In 3 min, the job is done. Formerly an adhesive was applied manually by roller.

Robot Erases Finger Prints

H. W. HUBBARD, Power Sales Engineer, Public Service Div of Commonwealth Edison Co, Joliet, Ill.

A semi-automatic electric washing machine is scrubbing objectionable finger prints from aluminum kitchen utensils made by Illinois Pure Aluminum Co, Lemont, Ill. These finger prints, left by plant workers, collected dust and were easily seen when utensils were displayed.

But this Stoelting Brothers Co spray washer solved the problem. It uses a water-soluble chemical to eliminate water marks. Utensils traverse the 40-ft-long machine on an endless belt, entering greasy and emerging clean. The machine has two 30-kw immersion heaters, 15 hp in conveyor and pump motors, and a 40-kw infrared drying oven.



THIS YOUR PRESIDENT SHOULD SEE

PENTA-treated poles going up: a wise investment in wood. Remind him that PENTA-treated poles cost no more, but have four long-lasting advantages.

We mean it. Take your president out on the job when a stretch of new line goes in. Point out the clean, strong PENTA-treated poles you depend on. Remind him first that PENTA* gives your poles *proved protection for full service life.* You can show him service records that demonstrate these poles resist rot and termite damage *years longer,* no matter what the climatic and soil conditions. This dependability means, among other things, fewer service interruptions and less customer irritation.

Then ask him to notice how easily the crew handles that *clean* but protected pole. PENTA-treated poles install faster, are easier to climb and work against. Still thinking of your system's customers, your president will probably mention what a good impression the pole's clean, natural appearance makes, too.

It's an even bet that your president doesn't realize you can *actually measure at all times* the amount of PENTA protection present in any pole. Only a uniform, one-compound wood preservative like PENTA gives you this running check on pole life expectancy.

The real clincher that makes a purchase of PENTA-treated poles the bargain it is: You can get all these advantages at *no extra cost,* making PENTA treatment the best buy in treated poles.

Finally, tell your president about all the user specifications that cite clean *PENTAchlorophenol treatment. Now . . . show him your copy of your most recent pole order. He's sure to ask if you've ordered *enough* PENTA-preserved poles. You did, of course, and thanks to wide availability you had no difficulty in locating a convenient source of supply for PENTA-treated poles. THE DOW CHEMICAL COMPANY, Dept. PE-979A, Midland, Michigan.

DOW

you can depend on DOW CHEMICALS

Heat Cable Lets Mine Run All Year

Electric heating cable is keeping a tin mine north of Nome, Alaska, open all year by warming a pipe that carries water from a source 9,000 ft away.

Believed to be the longest electrically heated pipeline in the world, the 6-in. pipe is encased in a 2-ft-square wooden box packed with mineral wool.

The pipe is heated by 54,000 ft of cable. Each element is 4,500 ft long and operates at 440 v. Water temperature at the source is 32.7F, but outside temperature dips to —80F at times.

Formerly the mine had to shut down after operating only 2½ to 3 months, but now it can run 24 hr a day all year.

The heating element is fabricated of wire completely insulated by Neoprene, for this substance retains its properties well at —40F. It can be specially compounded for service at temperatures as low as—60F. The compound actually employed is designed for 600 v and is especially formulated for low water absorption and heat resistant qualities.

INDUSTRIAL NEWS NOTES

Triggered Heat

A heat gun that blows 750F air is being marketed by Master Appliance Mfg Co, Racine, Wis., to help manufacturers accelerate production. Designed for localized heating jobs, this plug-in hand tool can do such jobs as speeding the drying of negatives or prints, or softening plastics.

•

Radio-Activated Molecules

In making your product, if you must apply heat to materials that do not conduct it well, a dielectric machine may help. It shakes up molecules to generate deep-seated heat in plastics, rubber and wood. This heat also can bake foundry cores, dry tobacco, thaw frozen foods in hotels, and cure false teeth at an overall electrical efficiency of 60%, points out Resdel Engineering Corp, Pasadena.

•

Depositing Metal

High-speed metallic deposits on small areas now can be made with new equipment of Marlane Development Co, Inc, New York. Equipment will build up worn parts and plate plastic-metal compositions. Manufacturer has figures for at least 18 metals that equipment will handle. E.g., on an area equal to pad electrode used, the equipment will deposit 0.0001 in. copper or cadmium in 2.5 sec at a current density of 6,000 amp/sq ft, or chrominum in 63 sec at 4,000 amp.

•

Dolls Born of Power

Electricity is helping baby doll manufacturers meet the clamor of their small-fry clientele. Horsman Dolls, Inc, reports that it used 1.2 million kwhr in 1954, double its consumption of 1946, to cure plastic "skin," make wigs and dresses, and run conveyors.

•

Boxing News

A machine that packs 200 receiving tubes a minute has increased output at Westinghouse Electronic Tube Div plant, Elmira, N. Y. It inserts 96,000 tubes a day into cartons, closes both ends, and prints the tube type on the outside. If done manually by one man, only 3,000 tubes would be packaged in the same eight hours.

INDUSTRIAL BRIEFS

Correcting low voltage by balancing the load at Lancaster County Swiss Cheese Co, Gordonville, Pa., enabled this manufacturer of domestic cheese to add 2 kw in refrigerating equipment wtihout a sizeable expenditure. By balancing the load, enough wiring capacity was released to permit the needed refrigeration equipment to be installed. Clyde Oberholzer, Industrial Representative, Pennsylvania Power & Light Co, Lancaster, Pa.

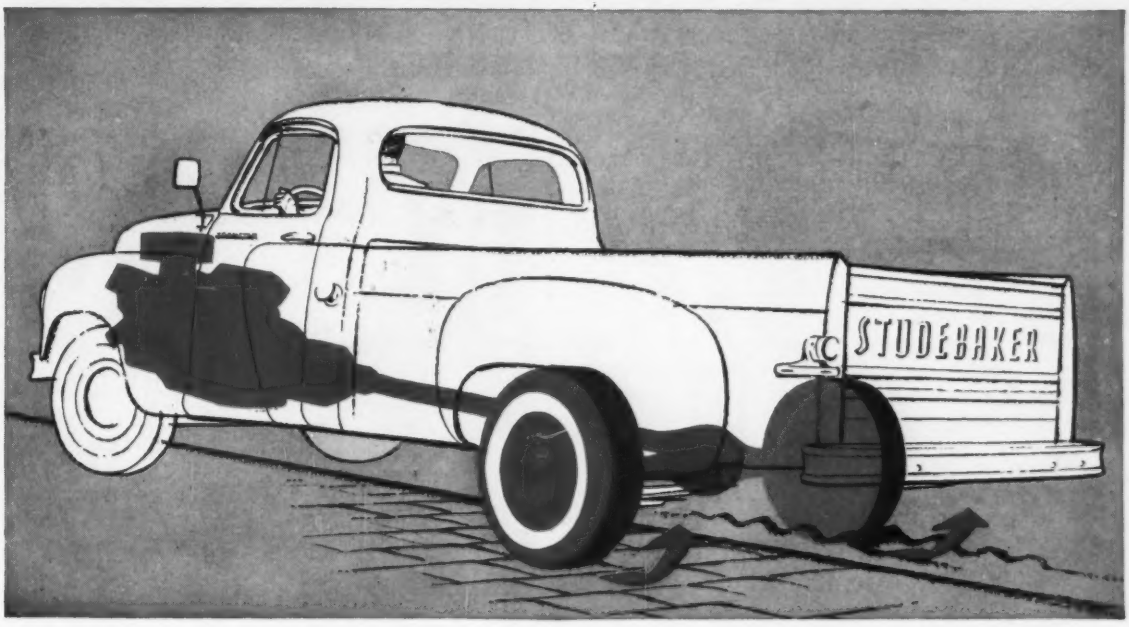
Improving tire production at United States Rubber Co, Detroit, has been accomplished with an electric arc machine process that adds the "nonskid" properties to tire casings. This property is imparted to the tire by a large number of shallow transverse slits in the bearing surface. The slits are made by 500 to 1,500 small blades that are inserted into the tire mold after the tread design has been machined into it. But it is difficult to saw slots for these blades into molds of certain tread designs. Now these slots are machined into the mold with a 3-kw electric arc that takes all tread designs in stride. F. J. Jolly, The Detroit Edison Co, Detroit, Mich.

Melting coconut oil is now done electrically at Giant Distributing Co, Oakland, Calif. The oil arrives as a solid in 55-gal drums. Formerly it was spaded to cooking tanks. Now it is melted by a 2.75-kw, 240-v single-phase blade-type drum heater and is pumped to the tanks. Company officials are enthusiastic. Costs are considered negligible in view of the resulting convenience and improved sanitation. The company makes potato chips, corn chips, beef jerky, bacon crackling, and other snack items. Victor Alexieff, Industrial Power Engineer, Pacific Gas & Electric Co, Oakland, Calif.

Drying painted TV cabinets with an experimental 20-kw installation of infrared produced startling results for Columbia Industries, Inc, Columbia, Pa. Production jumped more than 50%. The company soon installed six ovens totalling 112 kw. Infrared now supplements gas-oven drying and helps the manufacturer meet cabinet orders from three major television set producers. Norman S. Hartman, Industrial Representative, Pennsylvania Power & Light Co, Lancaster, Pa.

NEW STUDEBAKER TRANSTARS

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★



First with Twin-Traction Differential!

New truck advancement
delivers power to both rear wheels—
even on ice, in snow, sand or mud!

You get new tractive efficiency with Studebaker's pioneering Twin-Traction differential. In mud, snow, sand, or on ice, it delivers "go" power to each rear wheel. Doesn't let one wheel spin and bog down. With this Studebaker advance, Transtar Trucks are more effective for off-road work. It makes handling, even on rough roads or at highway speeds, easier and safer, too. Drive a new Studebaker Transtar with driving power that always gets you through. Available on half-ton units. Don't spin your wheels. Order your new Studebaker Transtar Truck at your nearest Studebaker dealer's today.

CHECK THESE TRANSTAR TRUCK FEATURES:

- ★ Shortest stroke V8 in the industry—bar none!
- ★ Widest pick-ups and stakes in the low-tonnage field!
- ★ Passenger car ride with two-stage springs!
- ★ Easier handling with cross-link, variable ratio steering
- ★ Enclosed safety cab step and other safety features
- ★ Load-engineered extra strength, deep-frame chassis

TUNE IN "TV READER'S DIGEST"

STUDEBAKER TRANSTARS

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

star performers with saving ways

STUDEBAKER DIVISION OF STUDEBAKER-PACKARD CORPORATION—WHERE PRIDE OF WORKMANSHIP STILL COMES FIRST!

Bulb Bag Campaigns: How to Make 'Em Pay

A Texas power company and an Oklahoma co-op tell how they put more lamps into empty sockets. Their secrets: contests, displays, door-to-door selling

Co-op Promotion Moves 165,075 Lamp Bulbs

E. E. KARNS, General Manager, Western Farmers Electric Cooperative, Anadarko, Okla.

Western Farmers Electric Cooperative of Anadarko, Okla. and its 10 member co-ops sold 165,075 bulbs to their 50,000 customers in only three months. Sales have averaged slightly more than 164 kw per day and results indicate that $375,000 of bulbs per year will be sold.

The program was launched with a technical lighting clinic in Western Farmer's headquarters for managers, and sales and public relations personnel of the member co-ops. Conducted with the help of a lighting specialist from one of the lamp manufacturers, the meeting was told:

1. How to identify light sources.
2. Where to use specific light sources.
3. Scientific and mechanical developments.
4. Consumer benefits.
5. Merchandising methods adaptable to co-op use.

Soon afterward other clinics were held in each member cooperative's area for its employees and trustees, again with help from the lighting specialist. Less technical, they covered these subjects:

1. Why the cooperative should be interested in its members' lighting.

(*Continued on page* 123)

INTO EMPTY SOCKET goes new 3-way lamp thanks to door step salesmanship of Mrs Viola Carey (left) co-op employee

5,000 POSTERS offering free bulbs helped Central Power & Light back up dealer and employee sales in its Fall campaign

Central P&L Sells 3.45 Lamps per Customer

Operating on the philosophy that there is no better load than lighting, Central Power & Light Co, Corpus Christi, Texas, goes all out on a bulb campaign each fall aimed to put a year's supply of bulbs on every customer's shelf.

All employees and all dealers in the area are enlisted in the program. Incorporating competitive spirit with incentives, it strives to get maximum effort from all concerned.

It usually does. Last year's activity placed an average of 3.45 bulbs per residential meter, a sizeable increase over the 3.05 bulbs placed in 1954.

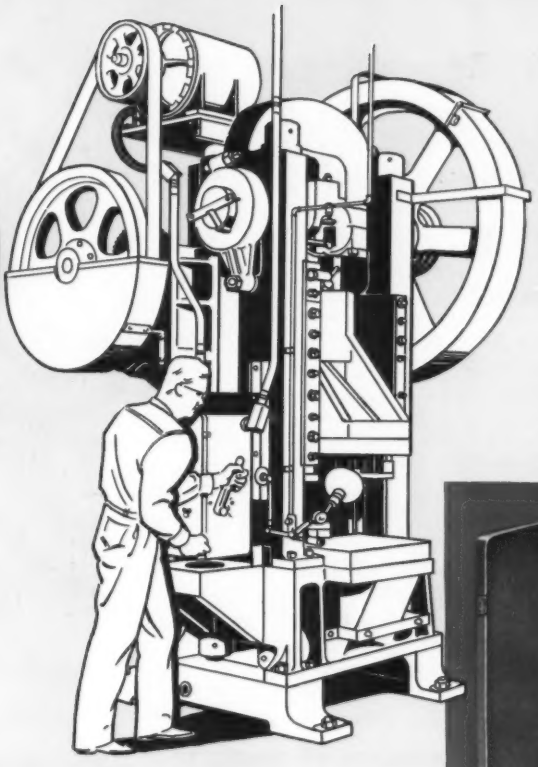
Activity promotes only 60-w bulbs and larger. The buyer is given a free 150-w bulb with each four bulbs purchased. Average wattage per bulb sold has increased from 80 w to 105 w since the promotions were started.

The activity is run each year during the entire month of October, and dealers plan their bulb promotions accordingly. An October "special" is offered consisting of a package of four 100-w, four 75-w, and two 150-w bulbs for $1.64, the retail price of the 100-w and 75-w bulbs alone. Thus the 150-w bulbs are free. The 10 bulbs are packaged in a polyethylene freezer bag stamped with a list of its contents.

CP&L reimburses the dealer for the full list price of each 150-w bulb plus a 5¢ bonus making its costs total 30¢ for each of the free 150-w bulbs. Dealers are urged to

(*Continued on page* 123)

The Sign of
QUALITY
Motor Control

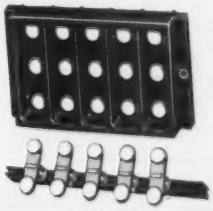


Bliss No. 207 Press in the plant of V. W. Danielson Manufacturing Co. It is started with an Allen-Bradley Bulletin 646 manual autotransformer starter, as shown below, with cabinet open to show air-break contacts and reduced voltage transformer.

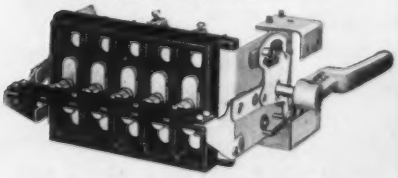
BULLETIN 646

MANUAL AUTOTRANSFORMER STARTERS with AIR-BREAK CONTACTS up to 75 HP, 220 V; 150 HP, 440-550 V.

Stationary and Moving Contacts of Bulletin 646 Reduced Voltage Autotransformer Starter



Cadmium silver stationary contacts are mounted in the arc hood and the moving contacts are on the crossbar.



Simple switching mechanism which first connects motor to reduced voltage taps and then shifts it to full line voltage.

Freedom from messy, oil-immersed starter contacts and oil tanks . . . that's the outstanding advantage of Allen-Bradley Bulletin 646 autotransformer starters up to 75 hp, 220 v; 150 hp, 440-550 v. This range covers most squirrel cage motors. The air-break, cadmium silver contacts need no maintenance.

The starting lever is so interlocked that the operator must pull the lever FIRST to the START position. After a preset, adjustable interval, a bell rings to indicate when the lever should be pushed into the RUN position. The starter is held in the RUN position by a magnetic latch, which drops out and stops the motor in case of overload or line failure.

In flour mills, grain elevators, and other places with explosive dust hazards, oil-immersed contacts must of necessity be used. For such applications an oil tank and copper-to-copper contacts can be supplied. Write for Bulletin 646.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

2-56-M

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

SMALL MOTORS
need overload protection too!

Because

SMALL MOTORS CAN BE AS IMPORTANT TO PRODUCTION SCHEDULES AS LARGE MOTORS

Here is an outstandingly popular starter for applications using motors of ONE HORSEPOWER OR LESS.

It is a small, manually operated starter that is equipped with a time-tested, reliable A-B overload breaker. A soldered ratchet trips the operating lever in case of a sustained overload. It is reset, after tripping, merely by moving the operating lever to the OFF position. Overload heater elements are available to cover the ratings of this starter.

The Bulletin 600 starting switch is available in single and double pole construction. Its double break, silver alloy contacts provide high interrupting capacity. The contacts are always in good operating condition. They never need to be cleaned, filed or dressed. Please write for a copy of Bulletin 600 for complete information on the Bulletin 600 line.

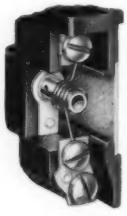
SIMPLE DESIGN

Simple ON & OFF snap switch . . . easy access to terminals . . . ample wiring space . . . silver alloy contacts need no cleaning or maintenance.

ATTRACTIVE APPEARANCE

Streamlined enclosure in grey enamel, and bonderized to assure positive binding of enamel finish to resist corrosion. The pilot light is optional.

OVERLOAD BREAKER



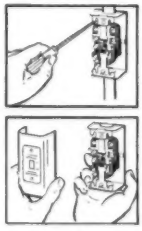
According to National Elec. Code ruling, motors of 1 hp or less, automatically started by thermostat, float switch, etc. must have overload protection.

FITS STANDARD SWITCH BOXES

Bulletin 600 starters fit any standard 2½ in. deep wall switch box.

Can be mounted in machine frame or base. Available with pilot light.

EASY TO INSTALL

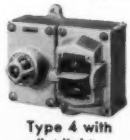


Remove 2 screws on front of starter . . . slip off cover . . . attach conduit . . . pull in wires and connect to terminals . . . replace the cover.

VARIETY OF ENCLOSURES

Type 7 for hazardous locations.

Type 4 watertight.



Type 4 with pilot light.

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

A-B Quality

ALLEN-BRADLEY

BULLETIN 600 STARTING SWITCHES

QUALITY

2-56-MR

Co-op Moves 165,075 Bulbs

(*Continued from page* 120)

2. What it means to the cooperative on a dollar and cents basis.

3. The difference between types of bulbs.

To get its ideas and active interest, discussion sessions were held with the audience following each meeting.

After the clinics each co-op was left to choose its own selling methods. Most prevalent was the package promotion. Six 100-w bulbs and one 150-w bulb were placed in a home freezer plastic bag. The bag was inscribed "Compliments of Your Rural Electric Cooperative." List price of the seven bulbs was $1.57. The cooperatives sold the bagful for $1.00—just a few cents more than their cost for the bulbs and the bag.

Bags were displayed in the lobby of all cooperative offices. They were carried by service trucks of crews working in the field. At annual meetings they were put on display, being sold at some and at others given free of charge to members as they registered.

Several cooperatives went further. Employees made house to house calls selling the bags for cash or charging them on the member's electric bill. It was not uncommon for one field representative to sell 50 bags plus a variety of other lamps in one day's work. Employees quickly found there was a demand for other types of bulbs besides those offered in the bag deal.

Home demonstration clubs, 4-H clubs, and church groups joined in, too, by selling the bulbs as a money raising project. They bought bulbs at the usual $1.00 per bag and sold them at $1.25. The customer still saved nearly 35¢ per bag on the retail price.

CP&L Big Seller of Bulb Bags

(*Continued from page* 120)

use the profit on the free bulbs as incentives for their salesmen.

Employees handle house to house selling. They get a 15¢ commission for the sale of a package of five bulbs, and 35¢ for the regular package of ten. When an employee has sold 100 bulbs he is given a wrought iron serving table. He receives a second one upon selling 200 more. After selling 500 bulbs he gets a $5 bonus plus another $5 for each additional 250. In some areas ambitious employees sell packages of 15 bulbs.

Whipping up this effort is a series of contests among the company's districts. Top employee receives a trip to Mexico City. District selling the maximum wattage per residential and rural meter is awarded the "President's" plaque. This competition is based on both employee and dealer sales.

Prizes also are set up within each district. They are based on ¾¢ rate per bulb sold until the quota is reached (two bulbs per meter), and 1¢ for each bulb over the quota.

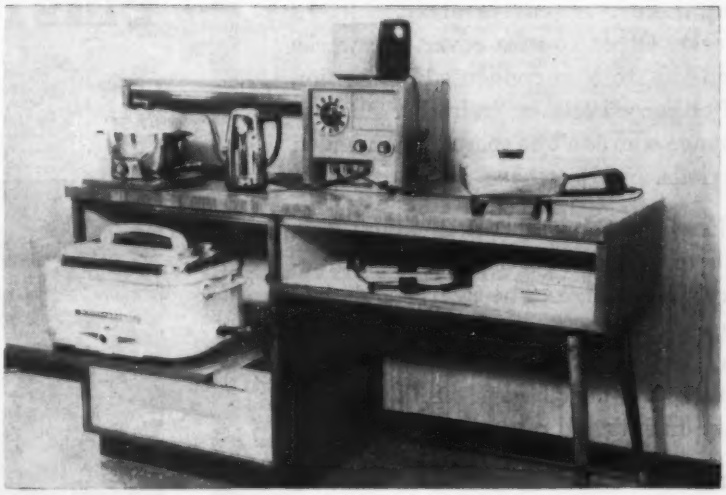
Extensive promotion backs the campaign: Advertising in 98 newspapers, radio spots and TV demonstrations, ads on service bills, fluorescent bumper signs on all company and employee automobiles, and employee lapel badges.

Displays are set up in company stores and show windows. Dealers are encouraged to stock up on bulbs and give them heavy floor and window space. Point of purchase materials are supplied by CP&L and lamp manufacturers.

New Plan Book Offered in Battle of Fuels

An "Action Plan Book" to help rural and suburban power suppliers better meet LP gas competition has been published by National Electrical Manufacturers Association's Competitive Fuels Sub Committee. The booklet analyzes some of the rural marketing conditions, offers sample marketing programs, and discusses the various promotional programs available. Much of its marketing data is taken from the now-famous "Beltsville tests." Some samples:

- 30% of all LP gas sold for domestic use goes to suburban residents.
- Every LP range on his lines costs the power supplier $39.12 per year, every water heater $82.32, and every refrigerator $9.84.
- Electric appliances are more efficient than bottled gas appliances—for cooking by a ratio of 2 to 1, for water heating by ratios ranging from 1.6 to 1 to 2 to 1, for refrigerating by a ratio of 11.6 to 1.



Replace the Range?

Westinghouse Electric Corp has introduced a new unit called the automatic appliance center that provides electric current for five electric housewares (it is wired for 220 v). It features pull-out extension cords, an automatic timer and selector, and a panel of circuit breakers with reset switches. Center is enclosed in a steel casing 1 ft high, 1 ft wide and about 11 in. deep. It will be produced in limited quantities this year and retail for under $100.

Practical service training at Honeywell's school . . .

makes your instrument men more valuable

Your instrument maintenance men can get a real education in the most up-to-date methods for servicing instruments, at Honeywell's Training School. Any organization which uses Honeywell instruments can send maintenance personnel to this school. Tuition costs you nothing, for this school is maintained as a "plus-value" service to Honeywell customers.

Thousands of technicians have either started or augmented their instrument knowledge here. A variety of courses is available, to fit men for the particular kind of maintenance problems they may encounter in their specific jobs. The comprehensive course . . . one of the most complete and intensive offered anywhere . . . covers about thirteen weeks. Other courses cover five weeks and less, to offer condensed instruction of either a basic or "refresher" nature to men who can't be spared for extended periods.

There's nothing academic about this school. The emphasis is placed on practical knowledge. Theory through lectures and textbook study is liberally supplemented by laboratory sessions and actual bench work on all types of instruments and related equipment.

One caution: classes have to be limited to assure thorough attention to all students, so make reservations in advance. Your local Honeywell office will be glad to make arrangements. Call today . . . it's as near as your phone.

Fast-growing Florida P&L finds plus values in

Honeywell service man Hugh McManus (right) advises FP&L electrician on how to check performance of a new ElectroniK recorder.

At Florida P&L's Cutler station, largest in the state, Honeywell field engineer W. L. Bolton consults with C. L. Wolff, FP&L production supervisor. Any of the system's stations is only a few hours from Honeywell's Tampa office.

Honeywell service facilities

WHEN a utility is expanding as fast as Florida Power & Light, selection of instrumentation becomes doubly important. System capacity has tripled in the past ten years . . . will triple again in the next decade.

To both management and operating personnel, this pace requires something extra of instrumentation. Performance has to meet high standards. Deliveries have to be on schedule. Maintenance requirements must be held to a minimum . . . and service for installation, start-up and emergency readily available.

Honeywell instrumentation meets every one of these specifications and is used extensively in the company's statewide system. The precision, versatility and ruggedness of these instruments make them leaders in performance on turbine, boiler and pump boards.

Equally important is the close-at-hand service, for engineering consultation and maintenance, available from a nearby Honeywell field office. A telephone call brings a trained man within a few hours, to discuss design plans for control centers . . . or to help instruct local technicians in methods of instrument maintenance.

Prompt, competent service by field specialists near you is one of the extra values of Honeywell instrumentation for power plants. A wide range of instruments covers many of the most vital points of measurement and control in modern steam and hydroelectric stations. For a discussion of your specific plant requirements, call your local Honeywell field engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

112 offices throughout the nation

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

NEW EQUIPMENT

Pothead Terminal Cover

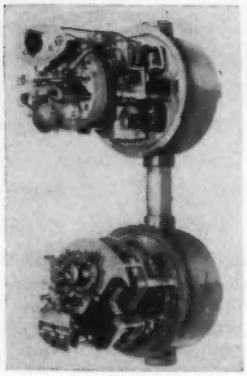
A Geon vinyl plastic cover has been developed for lead-in wire terminal connections for outdoor potheads. The device is reported to eliminate need for extensive electrical taping, to save installation time, and to prevent flash-overs from occurring when snow or rain seeps into the connection under ordinary electrical tape.

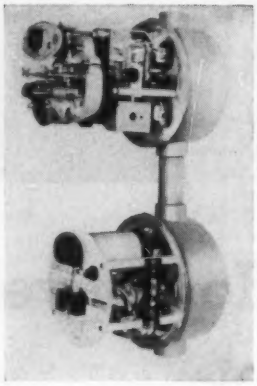
To install the cover, terminal leads are slipped through the two openings in the bottom of the trouser-shaped plastic cover and then attached to the electrical posts in the pothead. The vinyl cover is secured by wrapping electrical tape around its ends.

The flexible, weatherproof, plastic cover is made from a plastisol based on B. F. Goodrich Chemical Co's Geon vinyl resin.

Steere Enterprises, Inc, Akron, Ohio.

Capacitor Bank Controls



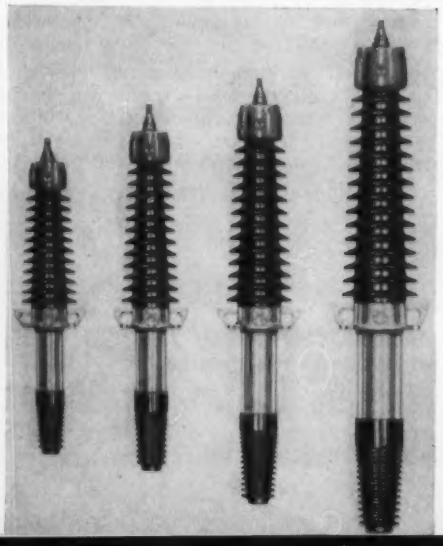


Two controls are designed to actuate oil switches for capacitor bank operation.

- Time-modified voltage control (left) consists of a voltage control and a time switch. The voltage control directly initiates switching action, while the time switch changes the operating level of the voltage control by removing or inserting a bias voltage. The time switch incorporates an omitting device that can eliminate the time function for any day or days of the week.
- Socket-mounted current controls (right) have either a high or low voltage override. When the voltage is within a predetermined limit, capacitor switching is accomplished by the current control. If the voltage exceeds the preset limit, the voltage control switches the capacitors to correct the condition. Time delay and fuse-protecting control and load circuits are included.

Line Material Co, Milwaukee 1, Wis.

Apparatus Bushings



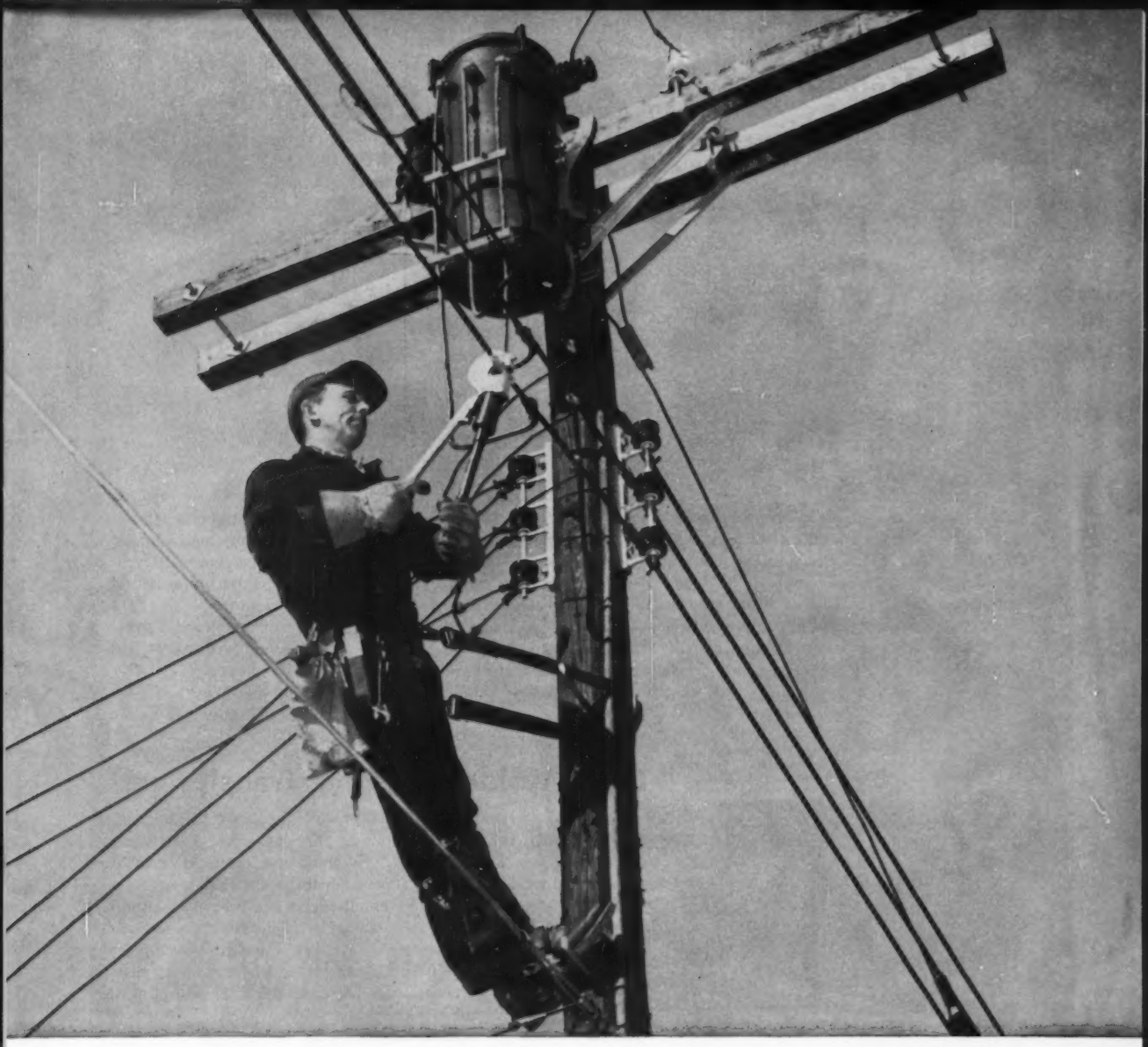
A line of small-diameter, light-weight apparatus bushings has been extended to include 230-kv operating voltage.

The additions, ranging from 69 to 230 kv, feature an insulating core of oil-impregnated paper surrounded with oil from end to end. This core utilizes full condenser construction comprised of multiple layers of foil and paper.

In the 115 to 230-kv range all bushings are equipped with magnctic oil level gauges and capacitance taps. Permanently tight sealing is said to be assured by spring compression assembly combined with improved gasketing.

Ohio Brass Co, Mansfield, Ohio.

(More New Equipment on page 128)



Depend on your Hubbard distributor...for everything in Pole Line Hardware

Hubbard and Company makes over 4,000 Pole Line Hardware products in their Chicago, Pittsburgh and Oakland, California plants. Machine bolts, carriage bolts, double arming bolts, lag screws . . . and everything else you need for your Pole Lines . . . Hubbard designs with special attention to the function the material must serve.

Bolts and lag screws are formed from new open hearth steel. They are double dip, hot galvanized in such a way that threads remain clean and smooth. Crossarm and double arming bolts have Hubbard's *Drivepoint* feature for fast installation.

Next time you order Pole Line Hardware, check with your nearest Hubbard distributor. Over 300 Hubbard distributors throughout the United States are ready to serve you.

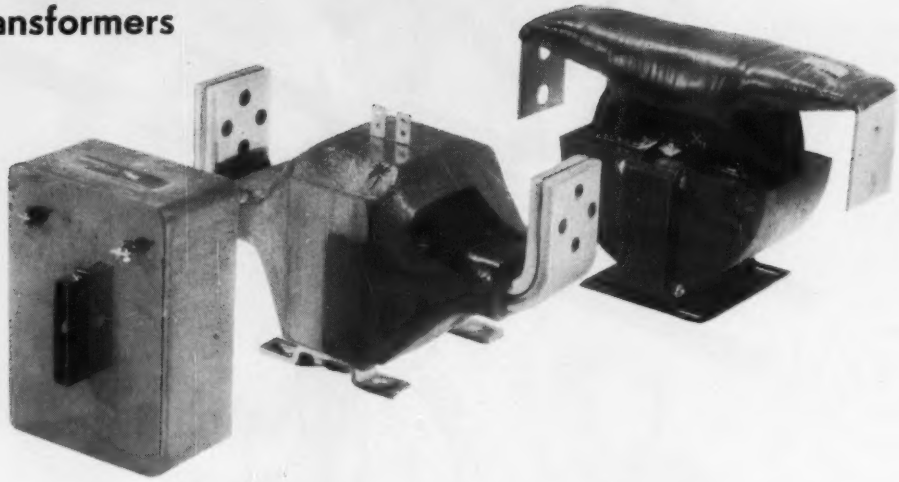
QUALITY! FOR MORE THAN A CENTURY

Secondary Racks • Wireholders • Pole Seats and Balconies • Braces • Drive Hooks
Wood Strain Insulators • Clevises • Extension Arms • Long Span Hardware • Pins
Clamps • Guards • Stubbing Bands • Guy Protectors • Guy Clamps • Pole Struts
Clips • Straps • Hangers • Carriage Bolts • Lighting Standards • Lighting Brackets
Eye Bolts • Pole, Corner and House Brackets • Guy Hooks • Strain Plates • Lags
Machine, Carriage and Hubeye Bolts • Sidewalk Guys • Autogap Lightning Arresters

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Calif.

Current Transformers



Core, coils and insulation have been redesigned on current transformers for 600, 4,160 and 13,800-v switchgear. Configuration of the core for low and high-voltage current transformers uses a "U" and "I"-shaped lamination design for efficiency and easy assembly.

On the window-type transformer secondary winding is of heavy Formvar insulated wire, and the entire assembly is cast in a resin for complete insulation.

The wound-type high-voltage current transformers of 5 and 15-kv class are of semi-cast construction. This is said to provide high dielectric strength, high impulse level, higher audible and oscilloscopic corona levels, greater mechanical strength, and a more uniform field between primary and secondary winding.

Features of the through-type high-voltage current transformers are similar to the wound-type except that all components are completely cast in resin.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

Butyl-Molded Current Transformer

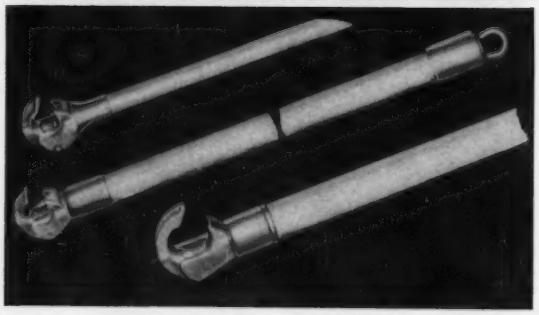
This 15-kv butyl-molded indoor current transformer is designed for metering and relaying applications. The new JKM-5 transformer requires no porcelain bushings, and the butyl serves as insulation, support and casing. The unit supersedes the older JKR-5.

The JKM-5 meets the 110-kv impulse level and for most ratings will stand continuous operation at 150% of rated current.

The new transformer is available in all standard, single-primary current ratings from 10 to 800 amp. It supplants transformers in two 15-kv insulation classes—the 15L and the 15H with full-wave impulse levels of 95 and 110 kv respectively.

General Electric Co, Schenectady 5, N. Y.

'Hot' Sticks



• Wire-holding stick (top) is used for forming, bending and positioning jumper wires, for holding conductors during splicing, and for pulling tie wires tight before tying. The gripper, equipped with an eye so that other sticks can assist with bending, can handle No. 8 solid copper through 4/0 ACSR.

• Wire tongs feature an extended upper jaw that overlaps the conductor to prevent roll-off while the jaws are tightened or loosened. Small, medium and large head sizes are available. Conductor range of the small head is 0.156 to 1.5 in.; of medium head, 0.36 to 2.0 in.; and of the large head, 1.5 to 2.88 in.

All poles are coated with Maplac plastic.

A. B. Chance Co, Centralia, Mo.

(*More New Equipment on page* 130)

Plymouth's lower costs save fleets big money!

It's a deal! The fleet buyer above is about to accept the bid of his Plymouth dealer and save *big* money for his company.

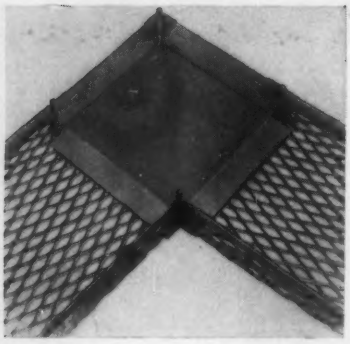
First, he'll get his handsome new '56 Plymouths at a low, low price. Under Plymouth's new Custom Fleet Plan, his order will be built to his *precise* specifications—with many features not available on other cars. And he can expect *prompt* delivery.

What's more, sizable savings will follow when his new Plymouth fleet reports for work. Plymouths cost *less* to operate than either of the other two low-price cars, as taxi records show! (No wonder you see *more Plymouth taxicabs than all other makes combined.)*

And think how much these beautiful '56 Plymouths will add to his firm's prestige! Drivers, customers and prospects naturally respect Plymouth's greater over-all size (biggest of the low-price three, inside and outside) and exclusive jet-age styling—tomorrow's look *today!* Inevitable result: more sales at lower selling cost.

To save *your* fleet big money, see your Plymouth dealer or write Plymouth's Director of Fleet Sales, P. O. Box 1518, Detroit, Michigan.

Best buy for all cost-conscious fleet owners! **Plymouth**



Cable Trough Coupling

Cable trough can be connected by this pin-type coupling. It secures the two coupler blanks with a pin that drops in place. The pin can be removed readily to permit any future changes.

The pin-type coupling requires three pieces for one connection. These are two pins and a plate that fits both over and under the bottom of the trough to protect the cable.

T. J. Cope, Inc, 711 S. 50th St, Philadelphia 43, Pa.

Tube Expander

This tube expander is air-operated and self-contained. It directly measures torque output in foot-pounds at the mandrel. This feature is said to eliminate tube over-rolling and under-rolling and to hold tube bowing to a minimum.

The 7½-lb, 10-in. long tool produces 14 ft-lb at 90 psi with maximum consumption of 12 cfm. Known as Torq-Air-Matic, the rotating tool has oil reservoir built into the handle. Manufacturer claims that control section is independent of the motor and that lubrication of the new tool is permanent.

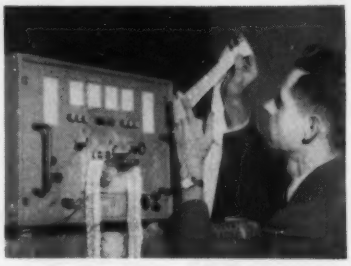
Thomas C. Wilson, Inc, 21-11 44th Ave, Long Island City, N. Y.

Electrical Tester

An automatic testing machine is designed for checking underground cables, communications and fire-control networks, other electrical test equipment, and generally any electrical or electronic equipment.

The machine, which uses a punched tape, determines whether correct connections have been made, correct components installed, and parts are in working condition.

Manufacturer claims the device can perform up to 120 complete circuit



measurements per min and detects 70 to 90% of failures of defective parts, excluding tubes or breakage resulting from a smashed chassis.

The 45-lb unit, known as the Robotester, is 20 x 13¼ x 18 in. It eliminates the "black box" or switchboard which is usually a component of test equipment.

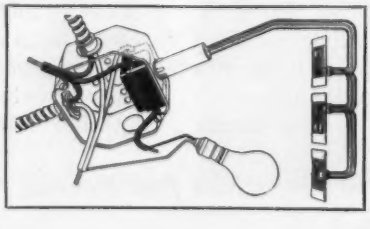
Lavoie Laboratories, Morganville, N. J.

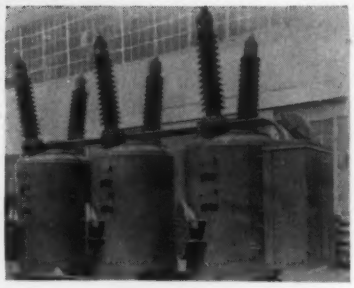
Remote Switching Device

Low-voltage remote-control switching is furnished by a relay with a built-in transformer. The wiring device, known as Remcon, fits into the standard outlet box.

Three-conductor No. 18 thermoplastic wire and silent contact switches are other components of the remote-control 6-v circuit. Manufacturer reports that Remcon circuits, which are independent and self-contained, furnish added economy and safety in residential and commercial wiring.

Pyramid Instrument Corp, Lynbrook, N. Y.



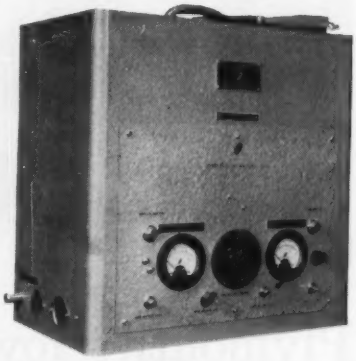


Oil Circuit Breaker

This oil circuit breaker is rated at 1,500 mva for 115-kv, 800-amp service. It features two-break rotary design with type OA-4 hydraulic operating mechanism. The manufacturer reports that the unit's design facilitates adjustment and maintenance and contributes to quiet five-cycle operation.

The breaker, designated as Type JHE-54, is skid mounted and shipped completely assembled with bushings in place.

Federal Pacific Electric Co, Pacific Switchgear Division, 5815 Third St, San Francisco 24, Calif.



Portable Power Supply

Three models have been added to a line of portable high-voltage dc power supplies for research and field-testing applications. Models 207, 208 and 209 are capable of providing up to 30 kv at 5 ma continuously, 6 ma for 4 hr at maximum voltage, and 7 ma continuously below 25 kv.

Model 207 has positive output polarity (negative grounded), while Model 208 has negative polarity, and Model 209 has reversible polarity. Relay rack mounting and other optional features are available.

Standard features include: Output

(*Continued on page* 132)

ROCKBESTOS VARNISHED-CAMBRIC CABLE

Quality Engineered to Provide Superior Performance

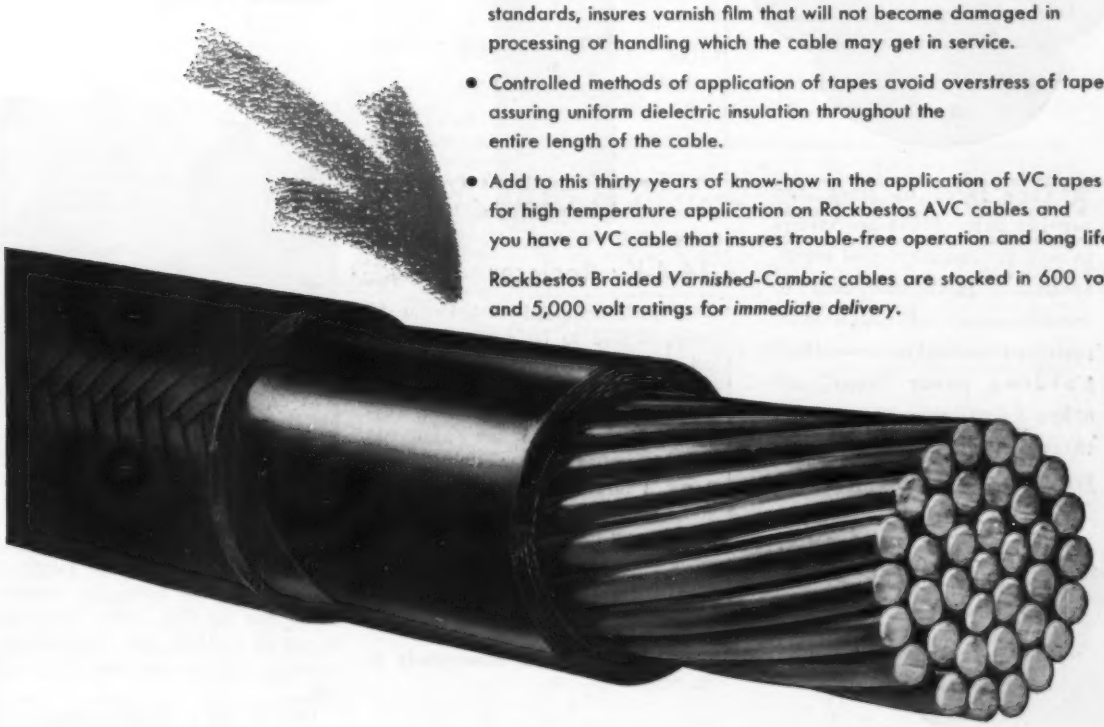
NOTE THESE UNUSUALLY HIGH STANDARDS FOR VARNISHED-CAMBRIC TAPES

Rockbestos VC tapes are made to our own exacting specifications which incorporate all the requirements called for in all IPCEA Standards.

PLUS

- A special surface treatment applied to insure that the tape will wrap properly to provide uniform dielectric strength and good bending characteristics in the completed cable.
- More rigid tape thickness requirements to insure uniformity of cable diameters.
- Rockbestos special Surface Hardness Test, not found in industry standards, insures varnish film that will not become damaged in processing or handling which the cable may get in service.
- Controlled methods of application of tapes avoid overstress of tapes assuring uniform dielectric insulation throughout the entire length of the cable.
- Add to this thirty years of know-how in the application of VC tapes for high temperature application on Rockbestos AVC cables and you have a VC cable that insures trouble-free operation and long life.

Rockbestos Braided *Varnished-Cambric* cables are stocked in 600 volt and 5,000 volt ratings for *immediate delivery*.



ROCKBESTOS
PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH • ST. LOUIS • LOS ANGELES
OAKLAND, CALIFORNIA • NEW ORLEANS

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick n.t housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
Manufacturers of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

New Equipment

(*Continued from page* 130)

kilovoltmeter; a continuously variable autotransformer; high-voltage "hold," "lock" and "off" pushbutton switches; line and high-voltage transformer input fuses; and an auxiliary 110-v outlet. Each of the three units weighs 43 lb and is 16-in. square by 9-in. deep.

Beta Electric Corp, 333 E. 103 St, New York 29, N. Y.

14-4-Kv Recloser

A recloser, rated 14.4 kv at 50 amp, is said to be compatible with all makes of hydraulically timed reclosers now in service.

One-way moisture seal and Thyrite coil protection are additional features of the new units which carry a three-year warranty on material and workmanship.

The new recloser is first of a complete series. The following ratings will go into production in 1956: 14.4 kv, 200 amp; 14.4 kv, 280 amp; and 23 kv, 100 amp.

General Electric Co, Schenectady 5, N. Y.

Addressing System

An electronic data processing system is designed to address a large volume mailing list. It consists of:

- High-speed punched-card-to-magnetic-tape converter that operates at speed of 600 cards per min.
- Selective magnetic tape recording system capable of recording data contained in punched cards on two to 12 separate tapes.
- Magnetic-tape-operated electronic printer capable of printing 3,000 lines per min.

A punched card is kept for each name on the address list. The entire file is fed through the converter coupled to the recording system, and magnetic tapes are produced. The printer then reads the tapes and turns out the final addresses at rate of 45,000 per hr.

The system records changes, extracts inactive cards, and performs similar maintenance operations.

Plans have been made to apply the machines to the large billing and data processing requirements of electric utilities.

Eastman Kodak Co manufacturers the apparatus. Distributor is:

Addressograph-Multigraph Corp, Cleveland 17, Ohio.

Portable Pruner

A 5-lb portable air-driven pruner has 4-in. cutting capacity. Fingertip controls operate both the vacuum brake and the 7-in. blade which has speeds up to 5,000 rpm. The unit operates at 140 psi and uses 17 to 20 cfm.

Overall length of the pruner is 76 in. Features include insulated handle, extensions designed for quick coupling, and motor located next to the saw blade. The pruner is available in an angle-head style for ground brushing.

Weed Control Service, Inc, Portland, Ore.

Plastic Laminate

A fluorocarbon plastic laminate, consisting of a 10 to 12-mil continuous layer of Kel-F plastic on glass cloth, can be adhesive bonded to almost any contoured surface.

Properties include: Tensile strength —4,000 to 5,000 psi; elongation—125 to 175%; resistivity—greater than 1 x 10^{16} ohm-cm; dielectric strength—3,000 vpm; dielectric constant—2.6 at 60 cps and room temperature; dissipation factor—0.010 at 60 cps and room temperature.

Other properties claimed are: High resistance to temperatures approaching 400F; resistance to chemicals.

The laminate, available in 36 x 46-in. sheets, can be cut with a knife or shears. It can be either cold or hot formed to flat surfaces or those with compound curvatures.

This plastic laminate was developed by M. W. Kellogg Co. It is made by: **Garlock Packing Co, Palmyra, N. Y. U. S. Gasket Co, Camden, N. J.**

Automatic Floodlight

This floodlight operates on the photoelectric cell principle to switch automatically on and off.

Some applications for the new light are: Burglar protection, industrial safety, fire detection, display purposes, and automatic night illumination for plants, commercial establishments, residences and parking lots.

The lamp (Model SJ) has an adjustable operation level. It is self contained, has 360-deg rotation, is totally automatic, and is available in 75 and 150-w sizes.

Lite-O-Matic Co, 2271 E. 14th St, Brooklyn 29, N. Y.

(*More New Equipment on page* 134)

MR. CARNEY answers the $1,929,880 question!

"Since 1946, we have accumulated a total estimated revenue of $1,929,880 on commercial electric cooking," says Mr. H. E. Carney, Manager, Commercial Department, Toledo Edison Company, Toledo, Ohio

READ MORE ABOUT the utilities' "poor little rich load"

"This revenue has been produced at a total cost of only $125,000," says Mr. Carney. "Our ultimate aim on Commercial Electric Cooking is a 2,500 kw per year increase until 1960. Then we will hit for a 3,000 kw per year increase. The demands on our plant and distributing system are so diversified that commercial cooking load seems to be a high profit load having a high utilization. The all-electric restaurant is the perfect customer. He has good lighting, good summer air conditioning, and continuous year 'round electric cooking. His demand in ratio to connected load is as low as any other kind of customer. His hours use of demand are long. Is it any wonder that we prize such a customer?"

Other top utility executives report as follows:

Mr. B. L. England, President, Atlantic City Electric Co., Atlantic City, N. J., says: "Commercial cooking load diversifies well with other classes of business and provides us with favorable revenue expressed in terms of system demand responsibility."

Mr. Roy S. Nelson, President, Gulf States Utilities Co., Beaumont, Texas, says: "We are most enthusiastic about our commercial electric cooking sales promotion as the equipment produces a fairly high annual revenue per kw of maximum load and offers the customers many benefits over other types of cooking."

You'll find more of these facts, directly from utility men, in the 12-page study made by ELECTRICAL WORLD, which reveals startling facts about Commercial Electric Cooking. For example:

- There are well over ½ million outlets for Commercial Electric Cooking equipment.
- The market is barely scratched—saturation as low as 5% to 15% in some areas.
- The estimated annual revenue from one small fry kettle equals that from four household ranges.

Read the story for yourself in this revealing report. Just have your secretary write to us today for:

COMMERCIAL ELECTRIC COOKING —THE UTILITIES' POOR LITTLE RICH LOAD

(There's no charge)

For the answers to specific questions, please communicate with any of the member companies listed below.

COMMERCIAL COOKING EQUIPMENT SECTION
National Electrical Manufacturers Association • 155 East 44th Street, New York 17, N. Y.

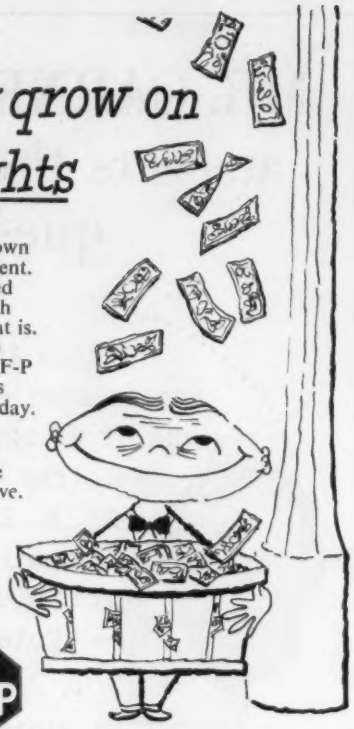
ASSOCIATED PRODUCTS, INC. • CORY CORPORATION • GRISWOLD MANUFACTURING CO.
HOTPOINT COMPANY • MARKET FORGE CO. • ROYCE L. PARKER, INC.
SAVORY EQUIPMENT, INC. • THE SILEX COMPANY • STAR MANUFACTURING CO.
TOASTMASTER PRODUCTS DIVISION McGRAW ELECTRIC COMPANY
WELLS MANUFACTURING CO. • EDWARD L. WIEGAND CO.

making money grow on .....streetlights

Although no one as yet has grown money on trees, *streetlights* are different. At least when some economy-minded utility engineer has equipped them with Fisher-Pierce photoelectric controls, that is. On low *first* cost, on reduced *installation* cost, and minimum *maintenance* cost, F-P units are producing substantial savings for the hundreds of utilities using them today.

The F-P *Series 64400* control is a good example. Low initial cost and infrequent repair make it practical to use *one 64400 per lamp*, as many utilities have.

Add to this economy the *basic* advantages of F-P photoelectric lighting controls: light *when* it is needed, independent of time, season or weather; *dependable* operation, a result of Fisher-Pierce's ten years of experience in this field. Facts and figures for the asking.

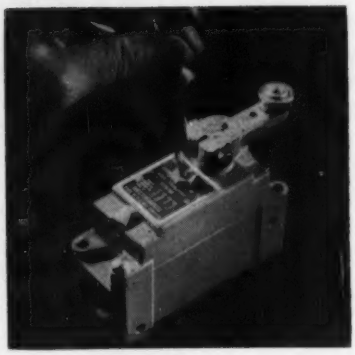


THE FISHER-PIERCE COMPANY, INC.
82 Pearl Street, So. Braintree, Boston 85, Mass.

EXPORT:
Philips Export Corp., 100 E. 42nd Street, New York 17, N. Y.
In Canada:
Northern Electric Co., Ltd.

P-L ANCHORS HOLD FOREVER!

PIEPER-LILLARD, INCORPORATED
YORKTOWN 5-4811 • 122 N. KIRKWOOD RD. • ST. LOUIS 22, MO.
ORIGINATORS OF THE BENDING HINGE ANCHOR



Limit Switches

Two limit switches are designed for machine-tool and general purpose applications. Type PLS lever-operated limit switch (illustrated) may be adapted for clockwise, counterclockwise, or universal operation by the turn of a screw selector. Type PRS limit switch (not illustrated) is actuated by depressing a push rod.

Both switches are available for flush or projection mounting, and both contain normally open and normally closed snap-action contacts.

The switches have identical electrical characteristics. Normal ac current ratings range from 15 amp at 115 v to 5 amp at 600 v; maximum dc ratings are from 2.0 amp at 115 v to 0.1 amp at 600 v.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

Parallel Groove Clamps

A line of parallel groove clamps is designed to eliminate weathering problems. The line features two types of clamps. One is designed for bi-metal connections. It is covered with Nicad, a heavy coat of cadmium and other corrosion-resistant elements. The second is for aluminum to aluminum clamps and has the same body without the Nicad coating.

The clamps are designed with large overlapping jaws to enclose fully the strands of stranded conductors. The clamps are said to be self-aligning and to maintain equal pressure on both conductors.

The line is furnished with lockwashers and galvanized steel hardware. Aluminum hardware is available.

J. A. Weaver Co, St. Louis 6, Mo.

MORE NEW PRODUCTS

Automatic Switch Co, 391 Lakeside Ave, Orange, N. J., has a ¾-in. general purpose 2-way **solenoid valve** with a full area port. The self-contained, internal-pilot-operated valve has a forged brass body and bonnet, and a hycar diaphragm.

Natvar Corp, Rahway, N. J., has a glass fabric **electrical insulation** for continuous service at 150C. The fabric, known as Isoglas, can insulate transformers, motors, generators, reactors, and similar equipment.

Millerbend Mfg Co, Winsted, Minn., offers a **lighting standard** to accommodate the slip-fitter type of fluorescent luminaire. The simplified design uses high-strength steel throughout and is available in all standard mounting heights.

Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J., has an **electronic motor control** for variable speed machine tool drives. The unit has preset or automatic supervision of motor characteristics.

International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill., has added a snowplow and backfill blade to its **4-wheel drive truck** model S-120 (4 x 4).

General Electric Co, Schenectady 5, N. Y., has two **fluorescent lamp ballasts.** The weatherproof units have a special zincplate, bonderize, and paint finish for protection against rust and corrosion.

Line Electric Co, 1407 McCarter Highway, Newark, N. J., has ac vibrating-type **buzzers** for warning alarms and signals. They are available in 12, 24, 115 or 230-v ratings.

Grieve-Hendry Co, Inc, 1401 W. Carroll Ave, Chicago 7, Ill., has a portable **industrial electric oven** that heats to 225F in 15 min. It measures 28½ x 24 x 20½ in.

Insul-8 Corp, San Carlos, Calif., has an **insulation bar** for use in plants where multiple electrical contacts are used with overhead power lifts. The bar, which is a Geon rigid vinyl extrusion, is said to have high dielectric strength with low power loss.

This is a sales manager?

That's right. Joe Warren is accustomed to having grease in his eyebrows. If getting a job out on time means Joe and *everyone* else at Royal pitching in on the production line—that's where you'll find them.

In order to give *every* customer the "Royal Treatment," we keep our operations flexible — gearing them to each individual job and *when it's wanted.*

If your needs include switchgear, any one of 5,000 standard connectors, or a special design to be engineered — call Royal. Two-to-one we'll guarantee you the fastest service anywhere . . . so try Royal *first,* and save even more time and trouble.

ROYAL

A part of the arsenal of AMERICAN POWER PRODUCTION

ELECTRIC MANUFACTURING CO., INC.
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

full 90° bend with one stroke of the ram . . . easy portability . . . extra versatility

Here's the kind of real portability you've been looking for in a bender for ½" to 2" pipe and conduit. Using light, but strong, aluminum alloy for many parts, the new GREENLEE No. 880 Hydraulic Bender is unusually *lightweight*, yet extra rugged, fast, powerful . . . produces 15 tons of ram force! One man can easily carry and operate it to quickly make uniform bends. Complete 90° bends can be made with one ram stroke. Separate two-speed hydraulic hand pump and bending ram simplify handling and setup. Easily operated by hand or may be teamed with a GREENLEE Power Pump for fast production jobs.

Attachments also available for bending thin-wall conduit, tubing, bus-bars. Get complete details on how to speed jobs and get better results with the new GREENLEE No. 880 Bender. Write for Bulletin E-217.

GREENLEE

GREENLEE TOOL CO.
1802 Columbia Ave., Rockford, Illinois

CATALOGS—BULLETINS

● **SWITCHGEAR:** Low voltage metal enclosed drawout switchgear using air circuit breakers is the subject of 16-page Bulletin No. 722. Photographs of component parts, cross-section drawings of indoor and outdoor units, two circuit breaker selection tables, and typical specifications are included. Nelson Electric Mfg Co, 217 N. Detroit, Tulsa, Okla.

● **GERMANIUM RECTIFIERS:** Form GR3105 (4 pages) describes a line of germanium rectifiers from 500 to 50,000-amp capacity in forced air or completely sealed water cooled design. Bart-Messing Corp, 229 Main St, Belleville, N. J.

● **NON-METALLICS:** Line of nylon, Teflon and specialty non-metallics is described in terms of properties and characteristics in 4-page Bulletin No. 50M1055. The materials are available in rod, strip, tubular bar, slab, flexible tubing, tape and plate. Polymer Corp of Pennsylvania, Reading, Pa.

● **ARC WELDER:** Dual arc control ac-dc welder is the subject of 8-page Bulletin No. 1343. Features, operation and uses are described. Lincoln Electric Co, Cleveland 17, Ohio.

● **MYLAR:** Latest applications of Mylar polyester film are described and illustrated in 22-page Bulletin No. A-682. E. I. du Pont de Nemours & Co, Wilmington, Del.

● **WELDING FITTINGS:** Folder FB-500 (6 pages) covers types and size ranges of various seamless welding fittings and flanges of alloy, carbon and stainless steel. Babcock & Wilcox Co, Tubular Products Division, Beaver Falls, Pa.

● **INSULATED CABLES:** A line of heat-resistant cables is the subject of Bulletin No. H-463. The 48-page data book contains description, current capacities, dimensional data, and engineering information. Tables, formulas, and graphs cover properties and characteristics. Okonite Co, Hazard Division, Passaic, N. J.

● **ANNUNCIATORS:** "Visual Alarm Systems" describes annunciators for use in power plants and industry. The 32-page brochure includes descriptions, illustrations, specifications, dimensions, schematics, and other data for every type in the annunciator line. Autocall Co, Shelby, Ohio.

● **CABLE INSULATION:** Suggested rubber compounding formulas for insulating wire and cable are given in Compounding Research Report No. 37. The 32-page booklet lists properties of a line of rubber chemicals for this application. United States Rubber Co, Naugatuck Chemical Division, Naugatuck, Conn.

● **SEALING GRIPS:** Water-tight line of high-lustre finished sealing grips for portable cords and cables used with all types of electrical equipment is described in 6-page Bulletin No. 629. Pyle-National Co, 1336 N. Kostner Ave, Chicago 51, Ill.

● **NEOPRENE:** Uses and applications of neoprene are covered in Neoprene Notebook No. 67. Effects of corona and ozone on stressed rubber are described in the 8-page brochure. E. I. duPont de Nemours & Co, Inc, Public Relations Department, Wilmington 98, Del.

NEW IRWIN 2-WAY "Hex" Shank Wood Bit

sectional view of 2-Way "Hex" Shank

fits both bit braces and electric drills

Use with hand brace as it comes. Order *without taper square shank*, or use hacksaw to convert to 2-Way "Hex" Shank for use in both hand braces and electric drills. It chucks perfectly—no wobble. Fast boring action speeds work. 2-way usage cuts inventory costs. Longer life cuts replacement costs. Hardened full length. Sizes 4/16 to 17/16". Call your mill supply distributor or hardware wholesaler for complete details.

IRWIN HEX SHANK WOOD BITS
Wilmington, Ohio

Remember . . . in the dynamic electric power industry, only World* can do World's* work . . .

***Electrical World** that is . . .

BOOKS

Books Received Since Jan. 9

Modern Physics. By Robert L. Sproull. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 491 pages, illustrated. Price $7.75.

Engineering Drawing and Geometry. By Randolph P. Hoelscher and Clifford H. Springer. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 510 pages, illustrated. Price $8.00.

Electronic Engineering. By Samuel Seely. Published by McGraw-Hill Book Co, 330 W. 42nd St, New York 36, N. Y., 525 pages, illustrated. Price $8.00.

Materials for Nuclear Power Reactors. By Henry H. Hausner and Stanley B. Roboff. Published by Reinhold Publishing Corp, 420 Park Ave, New York 22, N. Y. 224 pages, illustrated. Price $3.50.

Design of Piping Systems. By members of engineering departments of M. W. Kellogg Co. Published by John Wiley & Sons, Inc, 440 4th Ave, N. Y. 16, N. Y. 365 pages. Price $15.00.

Background in AC Equipment

Theory of Alternating-Current Machinery—Second Edition. By A. S. Langsdorf. Published by McGraw-Hill Book Co, 330 West 42nd St, New York 36, N. Y. 666 pages, illustrated. Price $8.50.

This revised edition includes a chapter dealing with the fundamental principles of mercury-arc rectifiers and inverters. New material also presented is an analysis of harmonics in T-connected transformers. As in the previous edition, the text covers the basic theory underlying the design and operating characteristics of all types of electromagnetic machines used in power applications. Omitted is all material on circuit theory.

The book is very comprehensive and the mathematical analysis rigorous. Illustrations and graphic material are timely and appropriate. It is an excellent reference for anyone in the electric power industry and very suitable for an undergraduate course in a-c machinery.

Report on Atomic Ventures

Atomic Energy Research at Harwell. By K. E. B. Jay. Published by Philosophical Library, 15 E. 40th St., New York 16, N. Y. 144 pages, illustrated. Price $4.75.

Light reading account of the British Atomic Energy Research Establishment from the year 1952 up to the formation of the United Kingdom Atomic Energy Authority in August 1954. The book is divided into two parts. Part I treats of the major projects carried on at Harwell and is written primarily for non-technical readers. Part II presents in more detail a few of the research projects underway and is written for the scientific readers who have not specialized in the nuclear field.

This is an excellent text for the reader who wants to keep abreast of international progress in this field.

MIF

malleable iron

HIGH CORROSION RESISTANT

Aerial Cable Clamps

Field tested and engineer approved on the basis of:

SIMPLICITY:
One unit—no separate clamp, spacer or pole plate.

VERSATILITY:
Can be used on both tangent and up to 90 degree angle structures.

CLEARANCE:
Eliminates chafing and abrasion of cable against pole.

COST:
Lower initial cost—fewer pieces to buy, inventory, handle and install.

Recommended by major cable manufacturers.

Prevent Pole Chafing of Aerial Cable!

For further information write for Bulletin PH2

MALLEABLE IRON FITTINGS COMPANY

Pole Hardware Division Branford, Connecticut
N.Y. Office: 30 Church St.
Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd. TORONTO

MIF

Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill., Lee-Smith Co., Miami, Fla. • B. H. McCoin, Knoxville, Tenn. • William J. O'Brien, Memphis, Tenn. • Robert P. Smith & Co., Jacksonville, Fla., E. A. Thornwell, Inc., Atlanta, Ga. • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Cal. • L. G. Wendegatz, Kansas City, Mo. • Williamson Sales Co., Shreveport and New Orleans, La.; Dallas, Houston, Tex.; Pine Bluff, Ark. • O. C. Witte Co., Detroit, Mich.

GE Bushings Use 'Printed Circuit' Core

Dielectric strength and reliability of high-voltage bushings are reported to be greatly increased by General Electric Co's new method of core construction. The method uses a "printed circuit" technique to achieve uniform dielectric stress through the bushing.

The new construction provides literally thousands of conductor equalizers. The latter are tiny graphite lines of conducting ink (25 mils wide, spaced seven per inch) printed on the kraft paper that is wound to form the core. Since the voltage drop between individual lines is infinitesimal, the gradient from conductor to ground is virtually uniform with no peaks of dielectric stress.

In the illustration J. E. Bergain (left) uses model of high-voltage bushing to show J. M. Dellea how printed conducting lines on core paper make thousands of voltage equalizers to strengthen bushing insulation. Bergain is a design engineer and Dellea is in the marketing section of GE's power transformer department.

Both GE and Locke Type U bushings from 115 to 230 kv are now being manufactured with the new method at General Electric's power transformer department, Pittsfield, Mass.

American Brass to Issue Book on Copper Buses

A comprehensive publication covering copper and copper alloys for electrical bus purposes is in preparation by the technical department of American Brass Co, Waterbury, Conn.

The 62-page publication, No. C-25, is entitled "Anaconda Copper for Electrical Conductors." It will carry statements and tables which are based on the company's years of experience in manufacturing and supplying copper in various forms for electrical engineering construction.

Content will be well arranged. In additon to description of the bus materials, numerous tables will present dimensions, properties and ratings of the various forms and shapes.

The book is expected to be available in 4 to 6 weeks. The American Brass Co advises that copies may be obtained free of charge when requests are made on an employer's letterhead.

A-C Earnings Dip; Sales Set Record

Net earnings of Allis-Chalmers Manufacturing Co in 1955 equaled about $6.00 on 3,944,362 common shares, R. S. Stevenson, president of the company, declared recently. Sales hit a record $535 million, up 9% from 1954, he said.

For 1954 A-C reported net earnings of $7.20 a share on 3,475,377 shares then outstanding.

Looking ahead to 1956, Stevenson observed that it should be as good a sales year as 1955, "and under favorable circumstances a little better."

The A-C president expected operations in the Power Equipment Division, which produces machinery for the electric power industry, to be at the same rate as last year. Orders on the books, however, indicate higher manufacturing schedules for this division beginning in early 1957.

The company's Industrial Equipment, General Products, Construction Machinery, and Buda Divisions will benefit from various national expansion programs, Stevenson said.

Dow Corning Ups Output, Cuts Prices of Silicones

The final unit in a $16-million plant expansion program was completed recently by Dow Corning Corp. The new plant facilities at Midland, Mich., are expected to double the previous methyl siloxane capacity.

At the same time Dow Corning announced a 7.5% reduction in its price of dimethyl silicone fluids and emulsions.

Silicone fluids are meeting acceptance for applications such as liquid dielectrics, water-repellant coatings for electric equipment, permanent light-load lubricants, and as damping media for timers, relays and dashpots.

Globe Has New Showrooms

Globe Lighting Products, Inc, New York, has opened redesigned showrooms for lighting fixtures. Recep-

(*Continued on page* 140)

104-mi. BPA Line Transmits Power to Willamette Valley

484 single-circuit steel towers used in new 230,000-volt line from McNary Dam to Maupin, Ore.

One of the Bonneville Power Administration's most recent major projects was construction of a 230,000-volt transmission line from McNary Dam to Maupin, Ore. The line, which was energized early in December, 1955, is the second to link the two points.

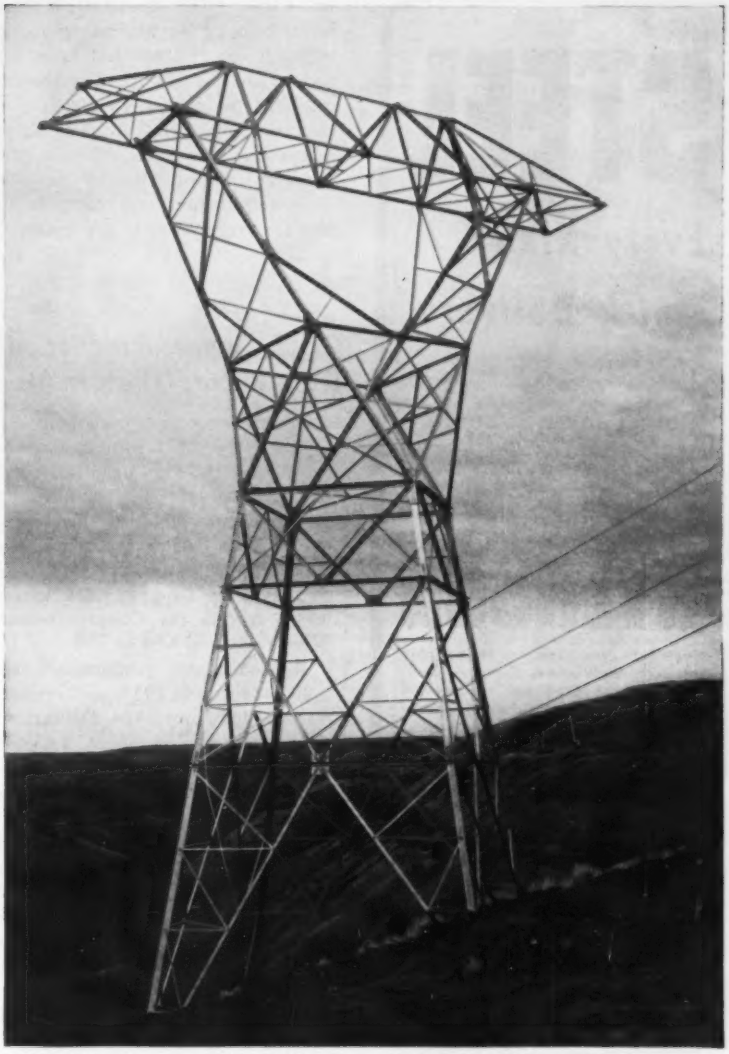
As shown on the map, McNary Dam on the Columbia River has its switchyards on the southern or Oregon side of the river. McNary-Maupin Line No. 2 carries power generated at the dam to Maupin, where it is distributed to the Willamette Valley load centers.

RUGGED COUNTRY . . . The forbidding landscape shown in the accompanying photograph is typical of the rolling desert terrain through which the line passes. Numerous canyons had to be crossed, requiring a number of spans of unusual length. Included are spans of 2,876 and 3,250 ft, as well as the near-record 3,742-ft span over Buck Creek canyon.

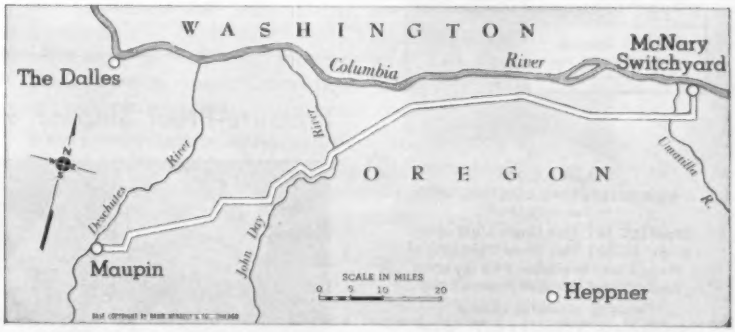
The line required 484 steel towers of the single-circuit type, ranging in height from 55 to 110 ft. They support three 1,272,000 cm ACSR conductors at 16,700 lb maximum working tension and were built to BPA designs and specifications. Due to the infrequency of lightning storms in this area, the BPA does not use overhead ground wires except near substations. They rely on high speed reclosing of circuit breakers to give system stability when lightning outages occur.

FABRICATED ON COAST... The steel towers for the line were detailed, fabricated and galvanized at Bethlehem Pacific's tower-fabricating shops in South San Francisco and Seattle. . . . In addition to its West Coast facilities Bethlehem is equipped to fabricate transmission towers and switching steel in the East at the Leetsdale, Pa., tower shop, near Pittsburgh.

If you would like to have further information about Bethlehem design and fabrication of transmission towers, just call the Bethlehem sales office nearest you.



This is Buck Creek canyon near Maupin. The span required here is 3,742 ft, one of the longest spans in the entire BPA system. Conductors of McNary-Maupin Line No. 1 can be seen in the background.



McNary-Maupin Line No. 2 extends in a southwesterly direction 104.4 miles from the McNary switchyards to the switching station at Maupin, nearly due south of The Dalles.

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tion area has a recessed dome in which is set a custom-made ceiling fixture with 27 lamps in polished brass perforated shades. In the first room is exhibited the company's 1956 "Continental" line primarily for shops, hotels and restaurants. In six other areas are shown types of the more than 400 fixtures that compose the line for every room in the house.

U. S. Copper Production Hits Record High in 1955

Production records were set in 1955 by U. S. primary copper as it soared 20% above the 1954 figure and 7.6% over 1951 production. The latter was the previous recorded high since World War II. Primary copper production in 1955 amounted to 1,037,580 tons, up from 863,721 tons in 1954, reports the Copper Institute, New York.

Refined copper production totaled 1,467,448 tons in 1955, an increase of 156,417 tons over 1954. Deliveries to fabricators totaled about 1,439,750 compared with 1,208,750 tons in 1954. Refined copper stocks at the end of December increased to 61,554 tons in 1955 from 47,108 tons at the end of 1954.

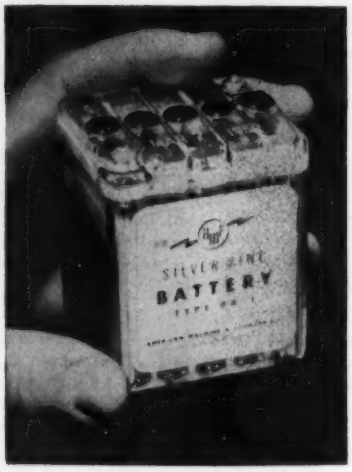
December, 1955, copper production figures are: Primary copper amounted to about 94,060 tons, a decrease of almost 220 tons from November. Refined production was 145,423 tons, up 11,712 tons from November. Deliveries to fabricators were about 138,800 tons, a decrease of 3,000 tons from the previous month.

Silver-Zinc Batteries Developed by AM&F

Silver oxide-zinc batteries are now under development at the Raleigh (N.C.) Laboratories of American Machine & Foundry Co. The batteries, ranging from this one comparable to a cigarette package to one the size of a jet aircraft battery, are designed to power electronic equipment.

The new batteries employ pile-type construction in which each cell is an individual battery. This feature prevents inter-cell action produced when the electrolyte causes contact between cells, according to a report.

The pile-type designs are in 0.1, 3.0 and 12.0-amp-hr sizes. The 12-amp-hr unit shows a yield of over 70-amp-hr per lb and 5-whr per cu in. High efficiency performances are realized down to 32F.



The batteries are for the Air Research & Development Command.

Pressure-Proof Shipper Protects Duncan Meters

A new shipper, reported to furnish stacking strength and reliable protection for glass meter enclosures, is expected to reduce packing costs. Duncan Electric Manufacturing Co of Lafayette, Ind., will use the unit for shipping watthour meters.

Interior inserts and packing pieces "float" four meters inside each box. This method is said to eliminate all pressure on the meters.

The shipper was designed by Hinde & Dauch of Sandusky, Ohio.

M&M BRIEFS

Hubbard & Co development engineers are exploring new aluminum alloy designs for pole line hardware, to reduce weight, use less metal than galvanized hardware, be more competitive in price, and to extend the use of corrosion-resistant hardware in industrial and seacoast areas.

Aluminum Co of America is adding 11,000 tons of capacity to its smelting operations at Vancouver and Wenatchee, Wash. The two northwest plants are slated to produce 206,000 tons, or 26% of Alcoa's 1956 output.

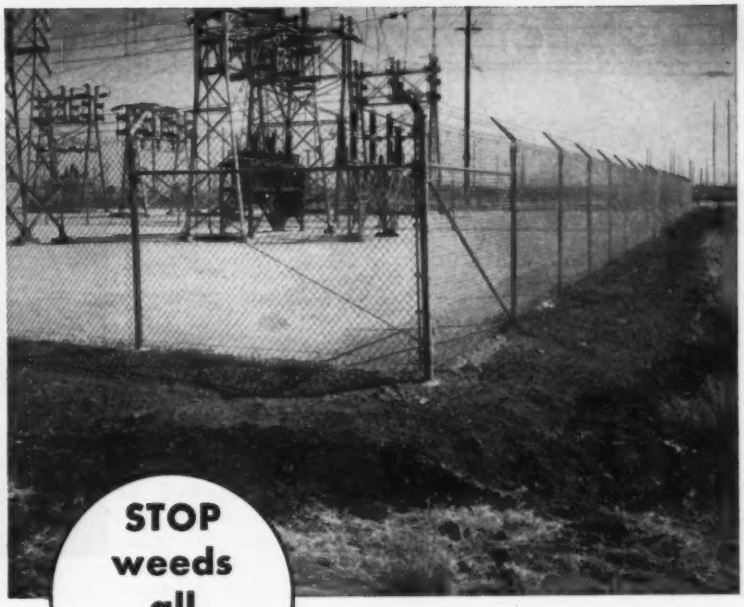
Sylvania Electric Products Inc will begin construction this month on a 78,800-sq ft warehouse and sales office near San Francisco. The office, slated for completion by Sept. 1, will serve northern California and nearby western states. Garlan Morse, director of Pacific Coast sales, will maintain headquarters there.

Westinghouse Electric Corp scientists set a third consecutive yearly record for submitting patent disclosures in 1955. The 1954 record was exceeded by 5%. Active inventors numbered more than 2,400. Out of a total of 44 engineering locations, 37 met or exceeded their 1955 invention bogeys. Top location of the tally were engineers in the aviation gas turbine division. Second on the list were engineers of the lamp division.

Union Carbide and Carbon Corp, New York, has formed a Silicone Division to assume responsibilities in the field of silicones previously handled by Line Air Products Co. For this new Division, William B. Humes has been appointed president and T. J. Coleman was named general manager.

Hanson-Van Winkle-Munning Co., Matawan, N. J., advises that a major price reduction on all germanium rectifier models is effective February 1. Some prices are reduced as much as 25%, depending on voltage and type of voltage control, H-VW-M reports.

Yale Associates, Marblehead, Mass., is a newly formed technical sales company for manufacturers of precise or complex measuring instruments. Gordon A. Yale heads the company.



Just one application of "Telvar" controlled weeds around this fence. Note the type of vegetation involved in untreated area in the foreground.

Spray just once with Du Pont TELVAR®

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When you use "Telvar" weed killers, vegetation is killed through the roots, and regrowth is prevented because the chemical remains in the soil . . . provides residual action all season long. And low dosages (1 to 1½ lbs. per 1,000 sq. ft.) make it cost little for the results you obtain. Such low rates also mean less handling, less use of storage facilities.

"Telvar" weed killers come as wettable powders, are non-corrosive, non-flammable, non-volatile, low in toxicity to humans and livestock.

Include "Telvar" weed killers in your weed-control program this year. Prove to yourself how these products of Du Pont research can help cut your maintenance cost to new low levels.

Where brush is a problem, Du Pont Ammate® X weed and brush killer is the product you need. It kills more kinds of brush with unusual safety. With ordinary precautions, "Ammate" X may be used close to such crops as cotton, tomatoes, soybeans and peanuts.

• • •

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada Limited, 80 Richmond Street West, Toronto, Canada.

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WEED and BRUSH KILLERS

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H. N. RAMSEY

W. H. JONES

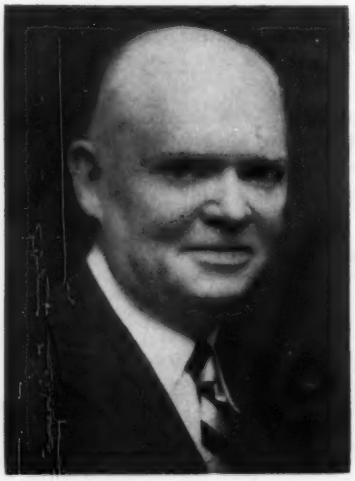
Philadelphia Electric Promotes Ramsey, Jones

Philadelphia Electric Co has elected H. N. Ramsey as executive vice president, and has named W. H. Jones to the post of vice president in charge of purchasing and service operations. Ramsey has also been elected a director, succeeding Edward Porter, senior vice president.

Ramsey entered the utility field as an engineer with American Gas Co and later became assistant to the general superintendent of the company. In 1931 he joined United Engineers & Constructors, Inc, to take charge of real estate operations and three years later was named president of the Welsbach Co. He was appointed purchasing agent of Philadelphia Electric in 1941, and vice president in charge of purchases, insurance, and real estate in 1948. A graduate of University of Pennsylvania with a mechanical engineering degree, Ramsey is active on committees of Edison Electric Institute and Pennsylvania Electric Association.

Jones has been associated with Philadelphia Electric since his graduation as a mechanical engineer from Cornell University in 1926. After serving as junior engineer, he became, successively, gas superintendent, electric superintendent, and division superintendent at Morton. He was appointed to the position of purchasing agent in 1949 and has served as manager of purchasing and service operations since 1955.

R. G. Rincliffe, president, has announced that company by-laws have been amended to make the president the utility's chief executive officer as well as presiding officer of the board. The office of chairman of the board has been eliminated.



V. M. F. TALLMAN

Elect Tallman Vice President

Vernon M. F. Tallman has been elected vice president of six utilities under the management of a Boston group formerly headed by the late Col Charles H. Tenney. Present electric operating properties include Rockland Light & Power Co, Concord Electric Co, Fitchburg Gas & Electric Light Co. and Exeter & Hampton Electric Co. Two gas companies, serving Brockton and Taunton, Mass., are also in the group.

Tallman's promotion follows the retirement of Frank S. Clifford after 53 years service. Clifford continues as a director.

Prior to joining the former Tenney group in 1920 he was associated with Worcester Electric Light Co as technical assistant to the president. Since 1920 he has served as power engineer, commercial and industrial manager, executive assistant and consulting engineer for the group. He is an electrical engineering graduate of Massachusetts Institute of Technology.

R. R. ZISETTE

Zisette, Jesionowski Named to Executive Posts

R. R. Zisette has been elected vice president-general manager and a director of Jessall Plastics, Inc, wholly owned subsidiary of Electric Storage Battery Co. R. S. Jesionowski, founder of Jessall Plastics, has been elected a vice president and director.

Previous to his new appointment, Zisette served as vice president of SKF Industries, Inc, with responsibility for sales and public relations.

As vice president, Jesionowski will supervise all manufacturing and development activities of the firm. In 1946 he founded Jessall Plastics which was recently purchased by Electric Storage Battery.

Other new officers of the company are E. J. Dwyer, secretary; E. W. Williams, treasurer; and M. G. Smith, comptroller. All have been named directors.

PERSONAL BRIEFS

New manager of Duke Power Co's industrial power department is **Channing B. Brown.** Vice president **Marshall E. Lake,** who formerly directed the department, continues to have general supervision.

Andrew W. Wofford has been appointed mechanical engineer of Connecticut Light & Power Co, with responsibility for the study, planning, engineering design, and construction of the mechanical phases of CL&P's steam and gas turbine generating facilities.

William H. Ferris, assistant chief electrical engineer, has been named chief electrical engineer of Wisconsin Power & Light Co. He replaces **C. F. Dobson** who retired Dec. 1.

Public Service Electric & Gas Co has announced the following changes in its electric department: **Walter C. Ames,** superintendent of Marion generating station, becomes superintendent of the Linden station now under construction; **Richard S. Hopkins,** superintendent of Kearny generating station, has been made senior engineer, general office, Newark; Essex station's chief engineer **John Allhusen** replaces Ames; and **LeRoy A. Brown,** chief engineer of Kearny station, becomes superintendent there.

Charles C. Corfield, formerly superintendent of Puget Sound Power & Light Co's Snoqualmie Falls hydroelectric plant, has been appointed superintendent of the White River and Electron plants. He succeeds **Shelley B. Trout,** retiring after 50 years of service. New Snoqualmie Falls plant superintendent is **Lewis F. Young.**

George G. Halfinger, manager of Ohio Valley Electric Corp's Kyger Creek station, has been designated assistant general manager of OVEC and its subsidiary, Indiana-Kentucky Electric Corp. **James B. Harreld,** assistant manager of Kyger Creek station, succeeds Halfinger.

Paul Anderson has resigned as a vice president of Hawaiian Electric Co to assume the presidency of Honolulu Electrical Products Co, a newly incorporated subsidiary which has taken over Hawaiian Electric's merchandise operations.

James F. Gordon has been named chairman of Public Service Commission in Kentucky. He succeeds **Robert M. Coleman** whose term has expired.

Arkansas Power & Light Co has named **James D. Sherwood** distribution superintendent at Malvern.

Cornell-Dubilier Electric Corp has appointed **William C. Otto** industrial sales manager of its Indianapolis Division. He was formerly chief engineer of the division.

Kenneth W. Hamming has been admitted to the partnership of Sargent & Lundy, consulting engineers.

H. R. Oldfield, Jr, has been appointed general manager of General Electric Co's newly established Industrial Computer Section at Electronics Park, Syracuse, N. Y. He was formerly manager of GE's microwave laboratory, Stanford Industrial Park, Palo Alto, Calif. **Kenneth R. Geiser** has been named manager of engineering for the new section. In addition, **Clair C. Lasher** was designated manager of marketing, and **George C. Trotter** becomes manager of sales.

Radio Corp of America has named **Rodolfo A. Correa** vice president of the commercial department. Since joining RCA in 1952, he had served as counsel for the commercial department.

New division sales manager for Reynolds Metals Co's San Francisco headquarters is **Richard N. Peters,** who has been head of the company's sales force in the Northwest for the past two years. **John Clearwater,** former aluminum conductor sales representative in the Northwest, succeeds Peters.

Burns & Roe, Inc, engineers and constructors, has elected **Edmund M. Kowkabany** a vice president. He was formerly assistant to the president.

OBITUARY

C. P. Conrad, 63, chairman of the board and former president of Iowa-Illinois Gas & Electric Co, died recently in his Davenport, Iowa, home.

James H. Ferry, 69, director and former executive vice president of Potomac Electric Power Co, died recently of a heart attack.

Eugene de Joly de Sabla, 90, founder of Nevada County (Calif.) Power Co, a predecessor of Pacific Gas & Electric Co, and first president of PG&E, died recently in New York City.

The goal for 1956

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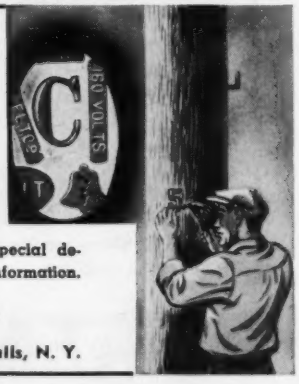

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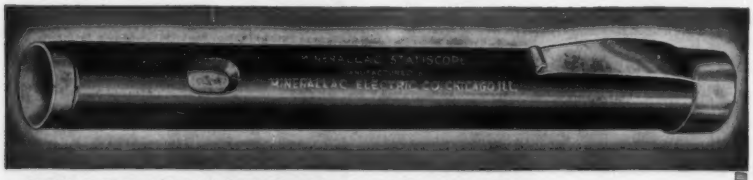

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SALES ASSIGNMENTS

COMPANY STAFFS

American Brass Co has designated John J. Moran as sales representative of its American Metal Hose Division with headquarters in St. Louis. L. C. Pratt represents the division at the Atlanta district sales office.

Burndy Engineering Co, Inc, has announced the appointment of Charles W. Ashby as manufacturers representative, servicing sections of Alabama, Tennessee, and Florida, with headquarters in Birmingham, Ala.

Crouse-Hinds Co, to tighten sales liaison throughout the northeastern U. S., has announced that the New England territory has become a part of the company's New York Sales Division. The enlarged territory will be supervised by Arthur F. Uhrlandt, manager of the New York Division, with Donald J. Parker reporting to him as manager of the Boston region. Parker succeeds Gordon V. Miller, recently transferred to the Philadelphia Sales Division.

Electric Controller & Manufacturing Co, division of Square D Co, has made the following district office staff assignments: Robert H. Owen will be located at the Cleveland sales office; Henry C. Williams has joined the Philadelphia sales office; N. Mark Hodapp has been transferred from Buffalo to Cleveland with responsibility for the Cincinnati territory; and J. M. Hyland transfers from Syracuse to East Aurora, N. Y. to service the Buffalo area.

Graybar Electric Co has appointed J. L. Cochran appliance sales manager for the Corpus Christi area, including 20 counties in southeastern Texas.

Joseph T. Ryerson & Son, Inc, has named Loren B. Clay manager of tubular products and cold finished bar sales at the company's Los Angeles plant. Former manager John R. Fennie has been assigned the Inglewood, Gardena, and Compton, Calif, area and J. W. Stevens has joined the sales staff to cover the Santa Monica, Culver City, West Los Angeles, and Beverly Hills territories. . . . William K. Underhill, assistant New York plant manager, has been appointed sales manager for the company's Connecticut plant.

Sylvania Electric Products, Inc, has designated Charles C. Beyer district sales manager, lighting products, for the newly formed Charlotte, N. C. district. The territory includes North Carolina, South Carolina, Kentucky, Virignia, and Tennessee.

Westinghouse Electric Corp has appointed Robert L. Allen district manager of portable appliances for Washington state, with headquarters in Seattle. He most recently was district manager for Montana, Idaho, and Utah.

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MEETINGS CALENDAR

FEBRUARY

EDISON ELECTRIC INSTITUTE—Commercial Electric Space & Air Conditioning Committee, Atlanta, Feb. 6-7; Industrial Power & Heating Group, Netherland Plaza Hotel, Cincinnati, Feb. 7-8; Transmission & Distribution Committee, Warwick Hotel, Philadelphia, Pa., Feb. 7-8; Electrical Equipment Committee, Homestead, Hot Springs, Va., Feb. 13-14; Commercial Lighting Committee, Hotel Shoreham, Washington, D. C., Feb. 15-16; Residential Promotion Committee, New York, Feb. 16-17; Commercial Cooking & Water Heating Committee, The Biltmore Hotel, Atlanta, Feb. 16-17; Meter & Service Committee, Hotel Cleveland, Cleveland, Ohio, Feb. 20-22.

INDUSTRIAL ELECTRIFICATION COUNCIL—National Industrial Electric Heating Conference. Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 6-10.

***WESTERN COMPUTER CONFERENCE & EXHIBIT**—sponsored jointly by AIEE-IRE-ACM, Fairmont Hotel, San Francisco, California, Feb. 7-9.

ELECTRIC COMPANIES PUBLIC INFORMATION PROGRAM—Inter-Regional Committee, Blackstone Hotel, Chicago, Ill., Feb. 9; Workshop Conference Committee, Blackstone Hotel, Chicago, Ill., Feb. 10.

***PENNSYLVANIA ELECTRIC ASSOCIATION**—Relay Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 9-10; Electrical Equipment Committee, Penn Harris Hotel, Harrisburg, Pa., Feb. 9-10; Communications Committee (Winter Meeting), Adelphia Hotel, Philadelphia, Pa., Feb. 13-14; Systems Operation Committee, Hotel Statler, New York, Feb. 16-17; System Planning Committee (Winter Meeting), Hotel Roosevelt, Pittsburgh, Pa., Feb. 20-21; Prime Movers Committee Meeting, Ben Franklin Hotel, Philadelphia, Pa., Feb. 23-24.

SOUTHEASTERN ELECTRIC EXCHANGE—Personnel Administration Section, Buena Vista Hotel, Biloxi, Miss., Feb. 9-10.

AMERICAN SOCIETY OF CIVIL ENGINEERS—National Winter Convention, Dallas, Tex., Feb. 13-17.

***CALIFORNIA MUNICIPAL UTILITIES ASSOCIATION**—24th Annual Conference, Mayfair Hotel, Los Angeles, Calif., Feb. 14-17.

AMERICAN MANAGEMENT ASSOCIATION—Midwinter Personnel Conference, Palmer House, Chicago, Ill., Feb. 15-17; 2nd Annual Electronics Conference & Exhibit, Hotel Commodore, New York, Feb. 27-29.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—Annual Spring Meeting, Mayflower Hotel, Washington, D. C., Feb. 17-18.

ROCHESTER ELECTRICAL EXPOSITION—War Memorial Building, Rochester, N. Y., Feb. 18-25.

NATIONAL ADEQUATE WIRING BUREAU—12th Annual Conference, LaSalle Hotel, Chicago, Ill., Feb. 23-24.

AMERICAN SOCIETY FOR TESTING MATERIALS—Committee Week, Hotel Statler, Buffalo, N. Y., Feb. 27-March 2.

MARCH

SOUTHERN SAFETY CONFERENCE, INC.—Southern Safety Conference & Exposition, Hotel Biltmore, Atlanta, Ga., March 4-6.

SOUTHEASTERN ELECTRIC EXCHANGE—23rd Annual Conference, Boca Raton, Fla., March 12-14.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—12th Annual Conference, Hotel Statler, New York, March 12-16.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Edgewater Beach Hotel, Chicago, Ill., March 12-16.

EDISON ELECTRIC INSTITUTE—Industrial Relations Committee, Muehlebach Hotel, Kansas City, Mo., March 15-16; Street Lighting Committee, Minneapolis, March 23-24; 22nd Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 26-29.

***TENNESSEE VALLEY PUBLIC POWER ASSOCIATION**—10th Annual Meeting, Farragut Hotel, Knoxville, Tenn., March 30-31.

APRIL

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—South West District Meeting, Baker Hotel, Dallas, Tex., April 2-4; Great Lakes District, Fort Wayne, Ind., April 16-18.

INDIANA ELECTRIC ASSOCIATION—16th Annual Young Men's Utility Conference, Hotel Van Orman, Fort Wayne, Ind., April 4-5.

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

MARYLAND UTILITIES ASSOCIATION—Annual Business Conference, Lord Baltimore Hotel, Baltimore, Md., April 6.

MIDWEST RESEARCH INSTITUTE—Symposium for Management on Applications of Analog Computers, Hotel Phillips, Kansas City, Mo., April 10-11.

POINT OF PURCHASE ADVERTISING INSTITUTE—10th Annual Symposium & Exhibit, Hotel Sheraton Astor, New York City, April 10-12.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Engineering & Operation Section, Hotel Vancouver, Vancouver, B. C., April 11-13.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

EDISON ELECTRIC INSTITUTE—National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, New York, April 16-18; Accident Prevention Committee, Sheraton Hotel, St. Louis, April 30-May 2.

GREATER NEW YORK SAFETY COUNCIL—26th Annual Safety Convention & Exposition, Hotel Statler, New York City, April 16-20.

***ATOMIC INDUSTRIAL FORUM, INC.**—Atomic Energy Conference, Atlanta, Ga., & Oak Ridge, Tenn., April 17-19.

PACIFIC COAST ELECTRICAL ASSOCIATION—Administrative Services Section Meeting, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-19.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Conference on Recording & Controlling Instruments, Bradford Hotel, Boston, April 26-27.

MAY

NATIONAL FARM ELECTRIFICATION CONFERENCE—LaSalle Hotel, Chicago, Ill., May 1-2.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Rochester, New York, May 2-4.

EDISON ELECTRIC INSTITUTE—Accident Prevention Committee, Sheraton Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8.

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

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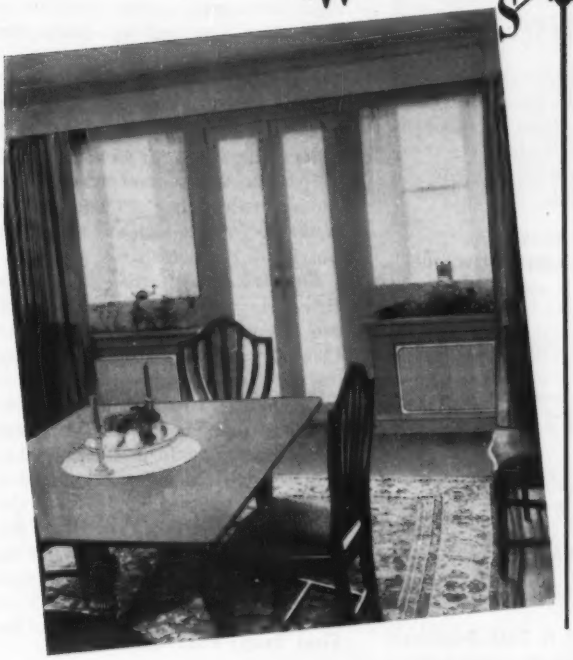
* Additions this week

OTHER EVENTS OF INTEREST

NATIONAL ELECTRICAL WEEK—Week of Feb. 5.

"LIVE BETTER . . . ELECTRICALLY"—Closed circuit telecast, Feb. 8.

Photographs courtesy of
Continental Radiant Glass Heating Corp.



NORTHEAST OR SOUTHWEST RA-GRID HEATER PLATES FIT THE JOB

Sub-zero weather in New England or a chilly night in Arizona, here's heating that's right. Ra-Grid* Heater Plates by Blue Ridge have the capacity to tackle tough heating loads, and the adaptability to add just a touch of heat when it's wanted.

Ra-Grid Heater Plates reach full operating temperatures in a shorter time than other heater plates. Due to special circuit design, the plate operates at more uniform temperature over the entire surface.

You can recommend and use Ra-Grid Heater Plates with confidence. The glass is tempered for greater resistance to thermal shock and impact. They're safer plates, because of lower temperatures on any part of the plate for a given wattage load. For over ten years, Blue Ridge has been making Ra-Grid Heater Plates for manufacturers who fabricate them into complete heating units.

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KINGSPORT, TENNESSEE

BLUE RIDGE GLASS CORP.

Linemen call this hoist a "HONEY"

Designed especially for line work

Here's a strong, fast-operating, light-weight hoist (12 pounds) with a flexible steel load chain that won't kink, bind or uncouple. Controls can be worked without removing gloves. It's rated to lift a one-ton load and it's tested to 3000 pounds.

THIS CHANCE HOIST HAS ALL THE FEATURES LINEMEN WANT

- Well-balanced, easy-to-grip handle. . . operates from either side
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- Hook link and full link take-up for accuracy and speed
- Easy working swivel hooks on both chain and hoist housing
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- All working parts fully enclosed in the housing to prevent injury to fingers.

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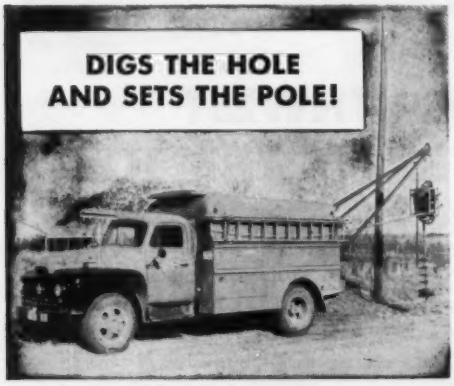

The F & H Self-Powered Hole Digger can be used on any type A Frame. Has own power for raising machine and turning auger. No power take-off shaft required. Available in 8-HP Briggs & Stratton and 14-HP Wisconsin engine. Uses either bucket or spiral-type augers. Dirt is thrown off the auger by spinning. Operated by only one man. All controls are mounted on digger. Write for complete information today.

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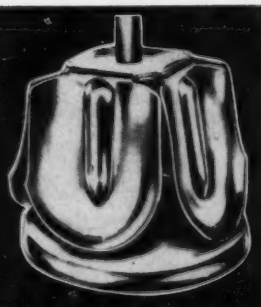

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Snake River Dams

. . . on Idaho-Oregon border present problems of income taxes, workmen's compensation

Idaho Power Co, in its Snake River development, is finding that there's more to building a dam astride state lines than just putting down the foundations.

For instance, there's the question of which state collects the local taxes and fees generated by the project. And when a man works for an hour or two in one state, walks across the dam into another state, and falls and injures himself enroute, which state pays his workmen's compensation?

Construction of the $87-million Hells Canyon projects, consisting of two dams on the Snake along the Idaho-Oregon border, is producing just such an auditor's headache.

Officials of Morrison-Knudsen Co, Inc, the dam builders, and Idaho Power met recently in Boise, Idaho, with state Attorney-General Graydon Smith and representatives of the various tax departments to hash out the problem. The meeting wound up with Smith being asked to confer with Oregon's attorney-general.

First Step: Find Channel

Their discussion will include such things as where is the center of the river, marking the legal boundary between Oregon and Idaho. It is not simply a point equidistant between the banks but the center line of the channel. So the channel must be found before the question of income taxes, revenue to workmen's compensation funds, property taxes, state withholding taxes, and unemployment insurance can be settled.

When construction activity reaches a peak this spring, from 800 to 1,000 men will be employed at the Brownlee and Oxbow sites. They'll be living on both sides of the river and interchangeably working on both sides. If a bulldozer operator lives on the Oregon side and does most of his work in Idaho, which state receives his income tax?

In the case of Oregon and Idaho, this question cannot be argued annually. For each state has a withholding tax similar to the federal government's. Idaho Power is considering a system that would apportion each man's pay for tax purposes according

to an estimate of how much time he works in each state.

Property taxes and electrical energy taxes promise to add another headache. Theoretically the dams could be evenly divided as to installed value. But is the power generating system part of the entire dam or, for property valuation purposes, located solely in the state on whose shore it happens to lie?

These are just a few of the questions the legal heads of Idaho and Oregon are going to have to solve before the states can properly apportion the state and local taxes represented by the river development.

POWER BRIEFS

● Negotiations are underway by Southern California Edison Co for purchase of an 80-acre site in the Huntington Beach area for construction of a $60-million steam generating station with two 200,000-kw generating units.

● Louisville Gas & Electric Co has applied to Kentucky Public Service Commission for approval of its proposed 125,000-kw, $17.6-million steam generator to be built at the Cane Run Plant.

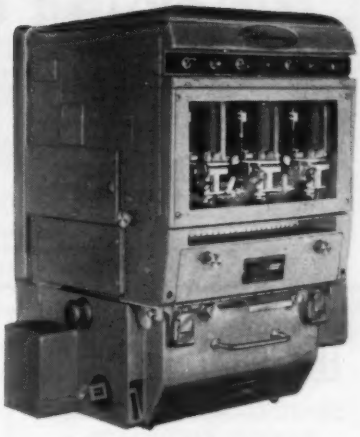
● Enlargement of Snoqualmie Falls station from 22,000- to 42,000-kw is planned by Puget Sound Power & Light Co. The $3-million project includes rebuilding the existing substation at the site.

● Florida Power Corp has begun installation of the 70,000-kw generator at its Suwannee River Plant, Ellaville. The addition, third unit at the plant, is scheduled for completion by the end of this year.

● Ohio Edison Co plans installation of two 170,000-kw generators for its proposed 340,000-kw, $62-million plant at Stratton on the Ohio River. Pennsylvania Power Co, a subsidiary, is making a 90,000-kw addition to its New Castle plant.

● Major expenditures of San Diego Gas & Electric Co's $18.4-million budget for 1956 include completion of Encina Unit No. 2, and preliminary construction of 106,000-kw Encina Unit No. 3.

RS-9 *Thirty*



RS-9 *Fourteen*

Hathaway Presents Two New Automatic Oscillographs

Now you can choose either the RS-9 *Thirty* or the RS-9 *Fourteen* to best meet your station or system monitoring needs. Each oscillograph is fully automatic. Each is equipped with internally mounted starting relays. And . . . because of the many types of Hathaway galvanometers and starting relays . . . each is adaptable to a wide variety of automatic recording applications.

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30 Channels	14 Channels
2-millisecond starting	2-millisecond starting
4 Internal relays	3 Internal relays
Simple cartridge loading	Magazine loading
Focal-plane calibrating screen	Recording beam viewing screen
12-inch wide chart	10-inch wide chart
Date and time on every record	Date and time on every record
Lamp automatically replaced on burnout	Individually adjustable recording beams

Write for Bulletins 2-F2-B and 2-F1-B

Hathaway
INSTRUMENT COMPANY
SUBSIDIARY OF
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The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

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P-9183, Electrical World
330 W. 42 St., New York 36, N. Y.

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LOCATION: Fast growing electric utility company in a large, progressive city in Florida, the nation's number one state in rate of industrial growth, and number two state in population growth.

RESPONSIBILITIES: Management of all engineering operations of company. Supervision and training of engineering department.

EXPERIENCE: Diversified engineering background in electric utility company, including a minimum of three years supervising engineers. Individual must have leadership ability, with potentiality for further advancement. Ability will be regarded as of greater importance than just years of experience.

AGE: 35-45 desirable.

SALARY: Commensurate with the high level qualifications demanded by the position.

REPLY: Confidentiality assured. Write, giving summary of qualifications to

P-8303, Electrical World
330 W. 42 St., New York 36, N. Y.

UTILITY OPERATING SUPERINTENDENTS

A fast growing electric utility in the West Indies has excellent opportunities for two graduate engineers with operating experience.

Asst. General Superintendent

Must be graduate engineer with utility operating experience including power plant operation.

Supt. of Transmission & Distribution

Must be graduate electrical engineer with experience at supervisory level.

Permanent positions assured to men of high caliber at liberal salaries. Ability to speak Spanish desirable. Qualified candidates will be interviewed in field at company expense. Successful candidates will be reimbursed for expenses incurred in moving. Vacation of two months every two years with liberal transportation allowance paid by company.

Include complete resume of education, experience, present position and compensation, and family status in first letter. All applications will be treated confidentially.

P-9161, Electrical World
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Electrical and Mechanical Engineers

Our engineering work includes distribution investigations, system planning, transmission line design, substation design, general gas engineering and the operation of steam electric generating plants.

Free group life and hospital insurance, liberal sick leave plan, five day week and a liberal vacation plan are but a few of the benefits you will receive. Engineering positions are available now for engineering graduates with less than five years of experience. Promotion from within means greater opportunity for you.

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Recent graduate for power distribution and electrical control design work in Engineering Department. Includes coordination of both power and control systems with process design, preparation of work and drawings for construction and construction supervision. Forward Resume to—

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SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITIONS VACANT

Design Engineer—Connector manufacturer looking for Utility-trained engineer acquainted with connector problems in the distribution field. Good opportunity. Reply stating age, education, experience and minimum salary expected. P-8929, Electrical World.

Graduate Electrical Engineers with or without experience for electric public utility. System protection, substation and distribution design work available. Please write full particulars: Personnel Director, P. O. Box 330, Hartford 15, Connecticut.

Electrical estimator for key position in long-established contractors office. Must have 10 years experience, state salary. P-9113, Electrical World.

Efficiency Engineer—Graduate engineer with at least two years' utility operating experience and basic knowledge of utility accounting functions. Will work directly under direction of Vice President in analysis of property operation. Must be free to travel 75% of time. Submit complete resume and starting salary desired. P-9068, Electrical World.

Safety Engineer having experience with elec-trical utility. Good opportunity with long established organization. Part time travel out of Chicago. Reply stating age, education, experience, and salary expected. P-9122, Electrical World.

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Salaried Personnel. $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personnel consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

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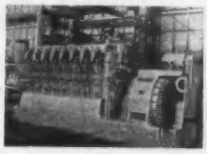
Stationary—Portable—Mobile

100 KW to 1500 KW



Engineered Diesel Power

"Union Light & Power Company" Cuba.

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1—500 H.P., 250 Lb. per Sq. In. gauge pressure, 5000 Sq. Ft. heating service, 3 drum, bent tube boiler with soot blowers—superheater, 6 retort underfeed stoker, and combustion controls. Frame work and all accessories. For complete details write Traverse City Light and Power Department, Traverse City, Michigan.

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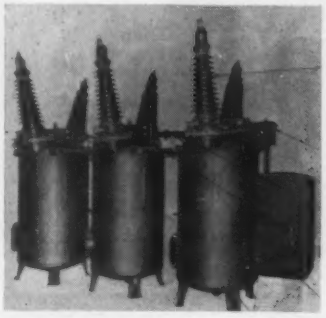

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3 phase, 60 cycle, 220 or 440 volt
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880	*G. E.	ATI	1.0	1200
780	*G. E.	ATI	.8	1200
640	*G. E.	TS-7648	1.0	900
480	Westg.	HG	1.0	900
380	G. E.	ATI	.8	720
300	*Ideal	SMM	.8	257
300	G. E.	ATI	.8	1200
250	G. E.	ATI	.8	900
250	Al-Ch.	SYN	1.0	1200
225	G. E.	TS-6244	1.0	300
255	El. Ma.		1.0	360
200	Fair.-Mor.	TJC-285	.8	720
150	El. Ma.		1.0	720
175	Al-Ch.	SYN	.8	1200
150	Fair.-Mor.	TJC-285	.8	720

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4	2500	Mol.	66000—13800
3	1500	G.E.	66000—2400/4160
3	500	West.	69000—7620/13200 Y
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900/11950
3	1250	A.C.	44000/115000—460
3	200	West.	44000—480
3	75	West.	44000—7200/12470Y
3	5000	G.E.	38100/66000—6600
1	3750	Penna.	38030/65865Y—13800, 3 ph.
4	3333	G.E.	38100/66000Y—33000
4	3125	Mol.	39900/66000Y—26600/46000Y
3	3333	G.E.	33000/11000—2400/7200
1	3000	A.C.	34500—2400/7200/12470 Y, 3 ph.
2	3000	Stand.	33000—4160, 3 ph.
1	2500	A.C.	34500—13800, 3 ph.
1	2000	Kuhl.	33000—6900, 3 ph.
3	667	A.C.	33000—2400/4160 Y
3	200	A.C.	34500—2400/7200/12470Y
3	200	G.E.	34500—120/240
3	75	Wag.	33000—240/480
2	3750	G.E.	26400—4360/2520, 3 ph.
6	2000	A.C.	26400/13200—2400
3	400	G.E.	26400—2400
4	1500	A.C.	25400/44000Y—6900/13800
3	333	G.E.	22800/13200—2400
3	100	G.E.	22000—7200/12470 Y
3	50	G.E.	22800—2300
2	3000	G.E.	13800—600, 3 ph. Unit Sub.
3	1200	West.	13800—600, 3 ph. Unit Sub.
1	1000	West.	13200—2300, 3 ph. Unit Sub.
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	200	G.E.	13200—2400
3	125	A.C.	6900—2300
3	50	G.E.	4800/2400—240/480
3	333	G.E.	2400/4160Y—460
3	200	West.	2400—240/480
3	150	West.	2400—230/115
3	100	G.E.	2400/4160—120/240
1	100	G.E.	2300—575, 3 ph.
6	50	West.	2400—114/228, Dry Type

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3— 500 KVA W-H 33000-2300/2400
3— 500 KVA G-E 22000-2300/4000Y
5— 333 KVA W-H 38000-7200/12470Y
3— 333 KVA A-Ch 13800-240/480
3— 333 KVA Wag 6900/11950Y-7200/12470Y
3— 333 KVA G-E 7200/12470Y-2400/4160Y
3— 250 KVA G-E 2415/2300-600
6— 200 KVA G-E 13200-2400/2300
6— 200 KVA G-E 13200-230/460
1—1500 KVA W-H 34500-2400/4160Y
3-ph., with substation equip't

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

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40 Years' Dependable Service

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY INC.
51 Howell St. — Jersey City, N. J.

If this red warning signal lights up
on the transformer near your home...
...it's a sign of healthy growth!
You and your neighbors have added many appliances, and are using more electricity. You've "outgrown" your present transformer just as your boys outgrow their clothes!
("What is a transformer?" you ask. It's a box on a pole that receives electricity at high voltages, and reduces it to the usable voltages your appliances need.)

DP&L Tells Public of Growth

Early last month Dayton Power & Light Co started an advertising and publicity campaign to call attention to warning signals on transformers. The objective of the campaign was to try and solicit the cooperation of customers in looking for these lights and at the same time convey to the public an understanding of the efforts being made by the company to improve service by anticipating trouble.

Above is a portion of the advertisement. The rest of the ad goes on to ask customers to call in to the company if they should see the red warning signal so that the company can check and correct the situation. Says the ad: "These signal lights represent a sizeable expenditure—but they're worth it. They help us anticipate your needs, and give you better service."

DP&L, through news releases to local papers, gave further explanation of the campaign. It informed customers that 20,000 transformers had been equipped with the warning signals; that when the light went on it indicated users had outgrown the transformer and that the company must make a correction. Because of the large number of transformers requiring observation, it is not possible to keep constant watch on all at the same time, DP&L points out. Therefore, the public might see a warning signal before a serviceman does.

The advertisement and newspaper publicity campaign was supplemented by radio commercials.

To date the investment in warning signals has cost DP&L over $100,000.

PR & A BRIEFS

• Reddy Kilowatt, Inc has announced May 12 as deadline for submission of entries for the 17th annual report contest.

• Wisconsin Electric Power Co has pledged to give the new Milwaukee zoo five jaguars, Pres G. W. Van Derzee has announced.

Clifty Creek Plant

. . . provides theme for Madison High School Year book which is dedicated to plant's builders

When Indiana-Kentucky Electric Corp built Clifty Creek Power Plant, the world's largest private steam plant, in Madison, Ind., it had a profound impact on the placid, college town.

The impact is perhaps best reflected in the Madison High School 1955 year book, dedicated to "all those who have devoted their time to the development of this Clifty Creek Power Plant."

It is evident that with an important segment of the community, the youth, Clifty Creek has got off to a sound start in its community relations.

The year book dedication notes:

"We, the members of the graduating class of 1955, realizing the seriousness of another world conflict, have symbolized a power plant as a pictorial pattern for our lives. During our construction period in Madison High School we have attempted to establish a foundation which will not succumb to the storms of life.

"Three towering smoke stacks are symbolic of traits needed to attain a better world for all: brotherly love, integrity, and patience. With charity toward all, with uprightness of purpose, and with the endurance of job we may produce steam and generate a current capable of influencing those about us.

"We consider it appropriate to use a power plant as an example for our lives, because of the recent construction of the Clifty Creek Power Plant and the tremendous effect it has had on our community. At the present time it is the largest plant of its type in the world. The electrical project has caused an influx of people which will necessitate an expansion of our fair city."

The year book maintains a power plant theme throughout, using such terms as "engineers," "boilermakers," "laborers," etc., to describe different classes. And the book's co-editor presented a copy to Philip Sporn, president of the company, and also of American Gas & Electric Service Corp.

For more economical operation

Modernize electric distribution systems with SORGEL air-cooled transformers or substations

INCREASE FEEDER CAPACITY AND EFFICIENCY BY TRANSMITTING ELECTRIC POWER AT HIGHER VOLTAGES TO LOAD CENTERS

The most practical type transformers to step down voltages at load centers are SORGEL air-cooled dry-type transformers. They can be installed in almost any convenient place inside of buildings, without fire-proof vaults or other enclosures. SORGEL transformers are of the highest quality, and require little or no maintenance. No liquid to check nor replenish; small and compact; easy and convenient to install; economical operation.

Increased efficiency — Because SORGEL transformers can be installed close to load centers, the result is shorter feeders, better voltage regulation, more efficient distribution, and lower wiring cost.

Quiet operation — The sound level of SORGEL transformers is well below the established standards. This outstanding feature is appreciated where low sound levels are an important factor. For that reason they are particularly adaptable for indoor installations close to load centers.

Easy installation—Attached wall brackets, with slots for bolts, or floor mounting base. No separate mounting brackets nor junction boxes to make or buy.

A perfect partner for substations — SORGEL transformers can also be incorporated in substations, complete with primary and secondary switchgear. They are procurable with any make of switchgear, and from any substation manufacturer.

Complete Line

¼ Kva to 2500 Kva, single phase.
1 Kva to 3000 Kva, 3-phase, 2-phase and phase changing.
All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, up to 15,000 volts, and any intermediate or special lower voltages.

Tested and approved by Underwriters' Laboratories under the Re-examination Service

Stock carried by jobbers in the following cities:

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Buffalo, N. Y.
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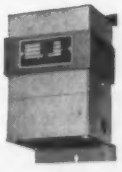
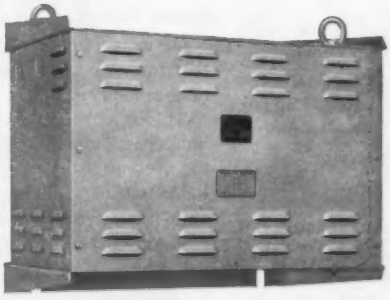
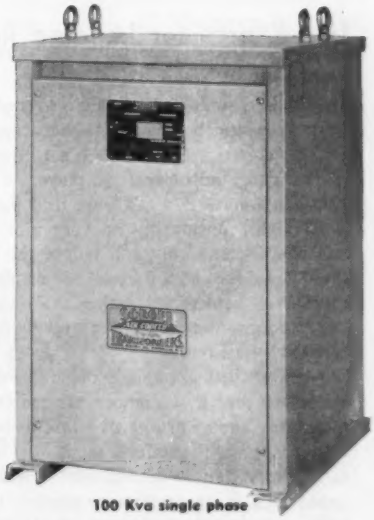
Also special transformers and saturable reactors



¼ Kva single phase 480/240 to 240/120 volts



15 to 50 Kva 3-phase. Wall Mounting type



100 Kva single phase

Consult the classified section of your phone directory or write to factory

SORGEL ELECTRIC CO., 834 West National Avenue, Milwaukee 4, Wis.

Sales Engineers in Principal Cities

READERS FORUM

Electric Heat Booster Says, 'Thanks'

To the Editor:

Please accept my thanks for the copy of the Nov. 14 Electrical World. I feel deeply honored by the appearance of my paper in your splendid publication. However, I am much more pleased by the fact that electric heating is now being accepted as the modern way of life by a great majority of the utilities in the United States.

It seems only like yesterday when we who believed in electric heat were in a very small minority and were looked upon with almost as much contempt as a Moslem shows when he looks upon an infidel. We were sure we were right however, and we stuck to our guns. Walton Larue of Wesix; Owen Hurd, manager of Benton County PUD; O. G. Hittle, manager of Cowlitz County PUD; L. N. Robertson, Robertson Cable Co; all played an important role in proving to the industry here in the Pacific Northwest that electric heating was good for both the customer and the utility.

With the progress being made in the chemical industry, it almost seems a sacrilege to use solid fuel material for heating when it could be used for durable goods. Hydro power, which we particularly here in the Pacific Northwest use, generally is wasted if it is not used. I have always viewed electric heating as a means of conservation of a natural resource rather than exploitation.

Thanking you once more for the privilege of telling our story through the columns of your magazine, I remain.

Lacy M. Peoples

Public Utility District No. 1
of Cowlitz County,
Longview, Washington

Use Kvarcs for Leading Reactive Power

To the Editor:

I find it somewhat difficult to understand what good purpose would be served by the acceptance of Mr C. K. Duff's suggestion (EW, Jan. 9, p 149) that "The conception of just one kind of reactive power . . . clears away much past confusion . . . Let's leave it at that."

It might conceivably be very nice indeed if we could consider income only and ignore the existance of income tax, but I doubt very much if the results would "clear away much . . . confusion," rather the reverse, I fear. Lagging and leading reactive power and their effects are, unfortunately, very real.

I believe that no serious objection will be offered to the statement that if we ignore the existence of lagging kvar and apply capacitors in an effort to remedy the effects of leading kvar, the effect might be somewhat less than satisfactory. The same would be the case if we added inductance in an attempt to remedy the effect of lagging kvar, ignoring the existence of leading kvar.

I am of the belief that we shall be best served by giving due recognition to the existence of both types of kvar and properly identifying them.

I concur with the editor's comment on Mr. R. C. Hunt's letter on the same page. This refers to the benefit of using pronouncable terms.

My suggestion is this. Let us use the familiar kvar for lagging reactive power only and use kvarcs (kay varks) for leading reactive power.

It seems to me that too much emphasis is placed on possible confusion in this situation.

Before the development of the electron theory, we generally accepted the statement that the direction of current flow was from positive to negative. The electron theory, however, states that electrical current is electron flow and that electrons flow from negative to positive.

This seems to me to provide much more ground for confusion than the use of kvar and kvarc, but it has been by no means an insurmountable confusion. I see little reason why the situation under discussion should prove to be any more confusing.

Alex C. Fraser-Lee
(Retired)

4560 Griswold Road
Port Huron, Mich.

Here Is the Way to Say It

To the Editor:

In accordance with your request for comments on terminology here is my contribution:

The ———— "KW" "Atomic Power Plant" which requires a conventional "Steamerator" in conjunction with a "Turbo-generator" with "Imput" measured in "BTU/hour" and output in "KW hours" can run thousands of "Electric Weatherators" to comfortably cool, as well as heat, the "Adequately Conductored Home" which is metered in "Multiples of Ten."

A. E. Hill
Transmission Engineer

New England Power Service Co
441 Stuart Street
Boston 16, Mass.

Long Life Lamps

To the Editor:

On page 62 of the Nov. 21 issue the statement was made that mercury lamps for street lighting give **twice** the life of incandescent units.

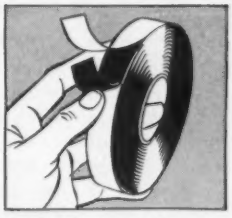
This is conservative. Most types are now rated 7,000 hours economic life but actually last about 12,000 hours on the average if the user wishes to keep them in service that long. Incandescent lamps are rated 2,000 or 3,000 hours with group replacement prior to that time, so this would make mercury lamps from 3½ to 6 times as long lasting.

William S. Till
Commercial Engineer

Westinghouse Electric Corp
Bloomfield, New Jersey

• Electrical World tries not to err; but if we do, we are happy to find that we have erred "conservatively."

New! Self-bonding butyl tape for high-voltage application!



"SCOTCH" 23 *Tape is heavy-gauge (35 mil) black butyl rubber with special liner for easy unwind.*

At last! A true high-voltage splicing tape! It's "SCOTCH" 23—newest addition to the famous "SCOTCH" Brand electrical tape family.

"SCOTCH" 23 Tape is compounded of a butyl rubber base and other selected materials to provide maximum protection for your high-voltage splices. It is designed for primary insulation applications, and wherever a "filler" tape is required; combines superior insulation resistance with high dielectric strength, excellent corona resistance, low dissipation factor and dielectric constant. It is non-corrosive to copper and silver; resists cold flow and cut-through, and is unaffected by ozone.

Self-bonding! "SCOTCH" 23 bonds itself into a solid, homogenous mass. Your splice is ready immediately for a final protective barrier-wrapping of "SCOTCH" Brand Plastic Tape. For further information, write 3M Co., Dept. BV-26.

Order a trial supply! It's individually boxed in ¾-in. x 30 ft. rolls. And when you're ordering, check your stock of plastic tapes in three thicknesses: "SCOTCH" 33 (standard weight), "SCOTCH" 22 (heavy), and "SCOTCH" 21 (extra-heavy). Be ready, be *right* with "SCOTCH" Brand!

REG. U.S. PAT. OFF.
SCOTCH BRAND **23**
Electrical Tape

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3M COMPANY

WASHINGTON COMMENT

Democratic Strategy for Niagara Power

Public power advocates are trying to unite behind Lehman Bill in the Senate but still face rough going in House. Democrats have power to block action

Democrats in Congress are trying hard to settle the Niagara power tangle—their way. They're putting on their big push for the public power bill sponsored by Sen Herbert Lehman, New York Democrat, in the hope of upsetting the 2-1 margin recorded against them by the House of Representatives during the Republican 83rd Congress three years ago.

However, the Democrats have a long way to go. Republicans argue that 222 of the 262 house members who voted for the Dondero private power proposal in 1953 are still in Congress. And though you can always expect a shift of a few members on a subject as controversial as this, especially after a lag of a year or two, it takes a lot of shifting to influence the outcome of a subsequent test.

Democrats Think Chances Are Good

Despite this, the Democrats feel they have a better chance of ramming through a public power bill than they've had for some time.

Here's what they are doing:

- Attempting to swing conservative Democratic Congressmen, by arguing there is no federal vs state argument here —only whether the State of New York or five private utilities should have the project. They've had some degree of success, particularly among newcomers such as South Carolina's Sen Strom Thurmond, a Democrat but a political conservative.
- Buttonholing colleagues with the threat that Canada is moving ahead independently without waiting for a U. S. project to get started. They are aided in this argument by the fact that Canada's project is public power.

This portion of the campaign was signaled several weeks ago, when New York Gov Averell Harriman told the opening session of the state legislature: "While Canada has acted promptly to take advantage of its share of this great resource, we have been delayed by opposition of those who would exploit the State's resources for selfish gains."

House Waits for Senate Action

Perhaps the push in Congress would not amount to much if it were not for the fact that Democrats' inroads in the Senate have been great under Democratic control. Even Republican private power advocates admit chances of the Lehman Bill passing the Senate are better than ever.

But there will be a fight there which the House will sit back and watch before it makes a move. Chairman Charles A. Buckley (D-NY) of the House Public Works Committee has introduced a House version of the Lehman proposal. But he will not act until the Senate takes its vote. At least, that's the strategy now, apparently based on Democrats' unwillingness to chance a risky House vote unless and until the Senate approves a similar measure.

The battle facing the Democrats is being illustrated daily by the reaction throughout New York State to a recent suggestion made by New York Republican Representative W. Sterling Cole. He recommended taking the matter to the people, by referendum. Response, according to recent reports, has been widespread, and indications are that the New York private utilities' proposal to develop the Niagara's hydro potential would win easily if Cole's suggestion were adopted. There is little likelihood of this being done, however.

But, in Washington, the Democrats hold the ace of spades: They promise private power advocates that, if they won't go along with a public power bill, all Niagara legislation will be blocked. They have the votes to do this.

TECHNICAL NOTES

Neutral grounding of electrical systems in chemical plants promises improved performance and prompt clearing of faults with minimum damage to equipment. The type of grounding can be selected to suit requirements.

Air conditioning of office buildings has made areas attractive that formerly were considered undesirable and has permitted use of high intensity lighting.

Rural service in Europe is predominantly at about 220/380 v, according to UN surveys. Secondary conductors range between No. 3 and 1/0 for Cu and the equivalent in Al. Area coverage four ways from large 3-phase distribution transformers reaches 100 customers averaging 0.5 kw diversified demand. Delivered voltage is held to ±5% generally, +7½ to −10% in exceptional cases and U.S.S.R. The Russians also limit flicker from motor starting to 20%.

Reinforced concrete construction saves critical steel in the framing for an Indian steam plant building. The roof is a reinforced arch and the walls, precast slabs.

Single generating units of 300 Mva represent more than half the surge impedance of a transmission line operating at 400 kv.

Field preheating is reportedly beneficial to older generators because maintenance costs and coil replacements are avoided by the minimized distortion.

Experimental model of Bell's new high-frequency transistor. It has a cut-off frequency of at least 500 mc and can be used to amplify 2500 independent voices simultaneously.

THE TRANSISTOR
that smashed a frequency barrier

A new transistor invented at Bell Telephone Laboratories can provide broadband, high-frequency amplification never before possible with transistors. The big leap in frequency is made possible by a diffusion process that earlier enabled Laboratories scientists to create the Bell Solar Battery.

This transistor is a 3-layer semiconductor "sandwich." High-frequency operation is obtained by making the central layer exceedingly thin. This was difficult to do economically by any known method.

The new diffusion process, however, easily produces microscopic layers of controllable thickness. Thus it opens the way to the broad application of high-frequency transistors for use in telephony, FM, TV, guided missiles, electronic brains and computers.

The new transistor shows once again how Bell Laboratories creates significant advances and then develops them into ever more useful tools for telephony and the nation.

A Bell scientist checks temperature as arsenic vapor diffuses into germanium, creating 4/100,000-in. layer.

BELL TELEPHONE LABORATORIES

IMPROVING AMERICA'S TELEPHONE SERVICE PROVIDES CAREERS FOR CREATIVE MEN IN SCIENTIFIC AND TECHNICAL FIELDS

Gas Ruling Affects Electric Utilities

- D.C. U.S. Circuit Court rules on accelerated amortization
- It issues order in case of City of Detroit vs FPC and Panhandle
- It claims normalized taxes important to arrive at revenue needs

A ruling of importance to the electric utility industry was issued recently by the U. S. Circuit Court for the District of Columbia in the case of the City of Detroit vs Federal Power Commission and Panhandle Eastern Pipe Line Co.

In this instance, while the ruling dealt with rate making in a gas pipeline case, the favorable implication to the electric utility industry, which has substantial investments in emergency facilities subject to accelerated amortization, are obvious.

Background of the Case

The background of this case (decided on 12/15/55) was a petition for review of an order of the FPC which, in 1954, had granted Panhandle an increase in rates in the amount of $12,780,000 instead of $21.4 million originally sought by Panhandle.

The petitioners in these proceedings were the City of Detroit and the County of Wayne, Michigan. The City of Detroit claimed, among other things, that the commission erred in its treatment of accelerated amortization by allowing Panhandle normalized taxes rather than actual taxes in arriving at the cost of service to Panhandle customers.

In dismissing the petitioner's objection, the court said: "We do not disturb the commission's solution of the problem created by federal income tax savings resulting from accelerated amortization. Such amortization is permitted under certificates of necessity, applicable to emergency facilities . . . to encourage construction in the interest of national defense."

Deferral of Tax Liability

The court continued: "Since, however, Congress intended by Section 124A only to defer tax liability, and not to provide a fund which could be diverted to Panhandle to the payment of dividends, the commission further states, 'the accruals for taxes in excess of those actually paid should logically be treated by Panhandle, not as free and unrestricted income, but earmarked to provide for the future meeting of such liability' ".

In dealing with the petitioner's objections to the FPC's method of normalizing taxes and setting up a special reserve, the court noted that "They (the petitioners) contend in order to hold rates to a 'just and reasonable' level, the savings effected by the accelerated amortization should partly inure to the benefit of consumers.

"They propose that this be accomplished by treating the saving simply as ordinary depreciation would be treated. That is, in computing recoverable expenses, the income tax expense would be figured at its actual, instead of 'normalized,' amount, but depreciation expense would be set at the accelerated figure. Thus the same saving would accrue to Panhandle, but under the name of depreciation expense rather than income tax expense.

Panhandle's Plan Cited

"The difference, however, would lie in this, that amounts recovered as depreciation expense are deducted from the rate base. Thus in essence petitioners' plan would allow Panhandle its yearly saving for the five year period, but would deduct the amount of that saving each year from the rate base.

"This plan was rejected by the commission, which concluded, we think correctly, that the intent of Congress reflected in Section 124A is not to benefit consumers but rather the taxpayer in order to encourage construction of certain emergency types of facilities. Were the tax savings deducted from the rate base, the taxpayer here would not receive the intended benefit. The valuations upon which it is entitled to earn a fair rate of return would be decreased by the amount of the savings.

"In placing the savings at the **disposal of Panhandle under the limitations specified, the Congressional intent is effectuated** (emphasis supplied). The funds go into a reserve account for the payment of the deferred taxes to accrue after the five year amortization period. Though thus earmarked, the funds are available for income-producing purposes.

Could Panhandle Benefit?

"Unless this is permitted, it is difficult to see how Panhandle could benefit substantially from Section 124A. This statute, unlike the Natural Gas Act itself, is not for consumer benefit. It has a different public policy and should be given effect as intended by Congress. Furthermore, the solution of the commission does not result in higher rates to the consumer. It simply does not operate to reduce them. It aids Panhandle but neither aids nor harms petitioners."

To date, 27 state commissions have issued orders with respect to the treatment of accelerated amortization of emergency facilities. Six commissions have made reference to the rate-making aspects of the tax deferral. The majority of orders have dealt only with the accounting requirements and specifically excluded rate-making.

PSC's Rule on Depreciation

Furthermore, in the case of liberalized depreciation, a number of state commissions have drawn heavily on the fact that liberalized depreciation is analogous to accelerated amortization in that Congress intended to benefit the taxpayer by a deferral of taxes. Of the 14 state commissions who have issued 18 orders, none of them has specifically ruled on the rate-making aspects of liberalized depreciation.

This order from one of the highest courts of the land gives the electric utility industry, as well as the commissions, substantial backing in claiming normalized taxes as an important element in arriving at the revenue requirements of a utility.

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WRITE for your new Standard Single-Phase Transformer Bulletin S-401-B. It's ready now!

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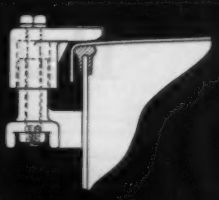
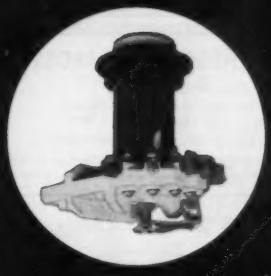
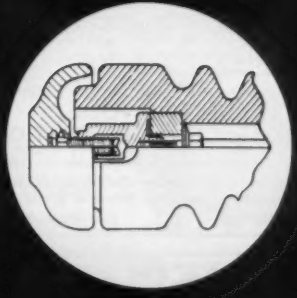


UNIFORM SEAL—This Standard design feature creates a four-point contact that assures a positive seal completely around the transformer cover. A Neoprene gasket seals out all dust and moisture.



TAP CHANGER—Your transformers can be equipped with four taps above or below, or half above and half below, as you specify. The switch embodies a contact-making assembly with a spring-loaded brass wheel for positive contact. Normal settings are with a four-tap voltage section. 2½% taps within 10% range of normal rating.



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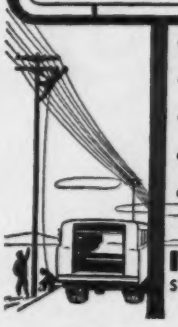

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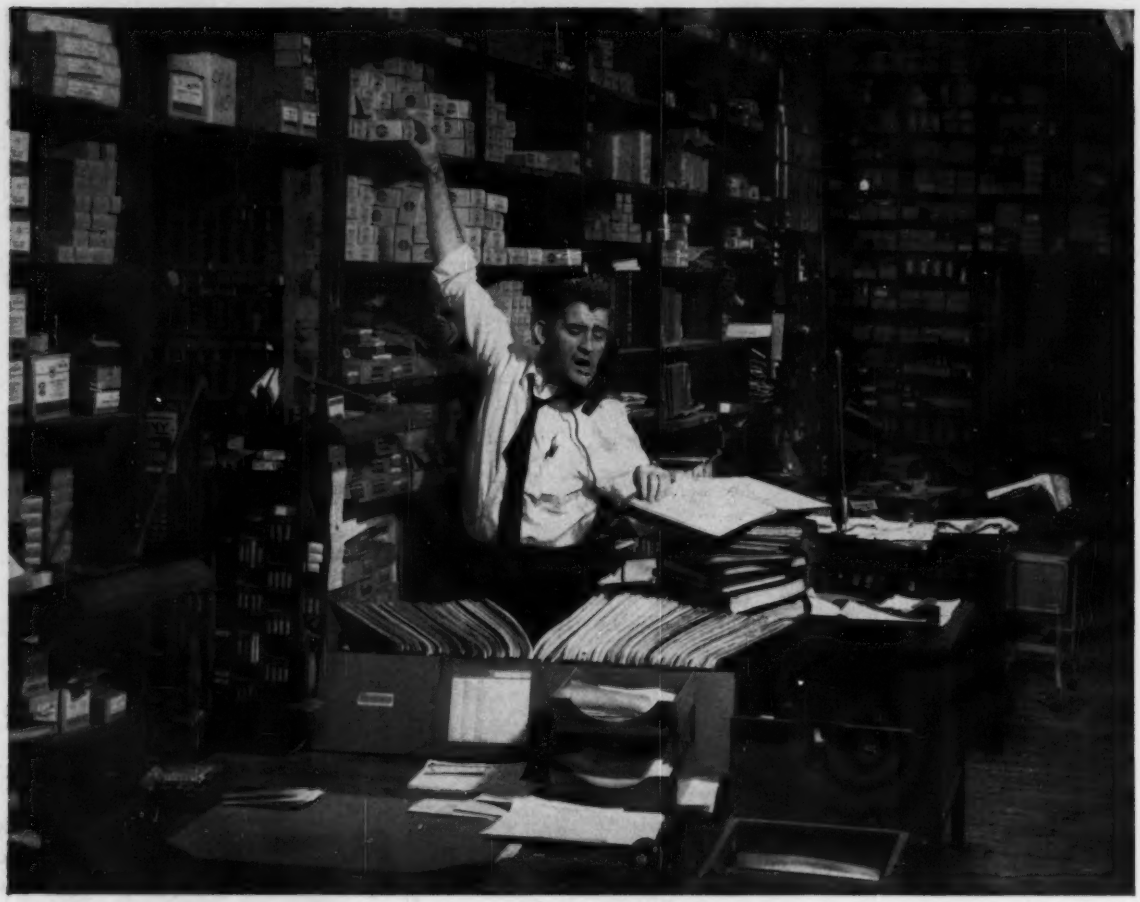

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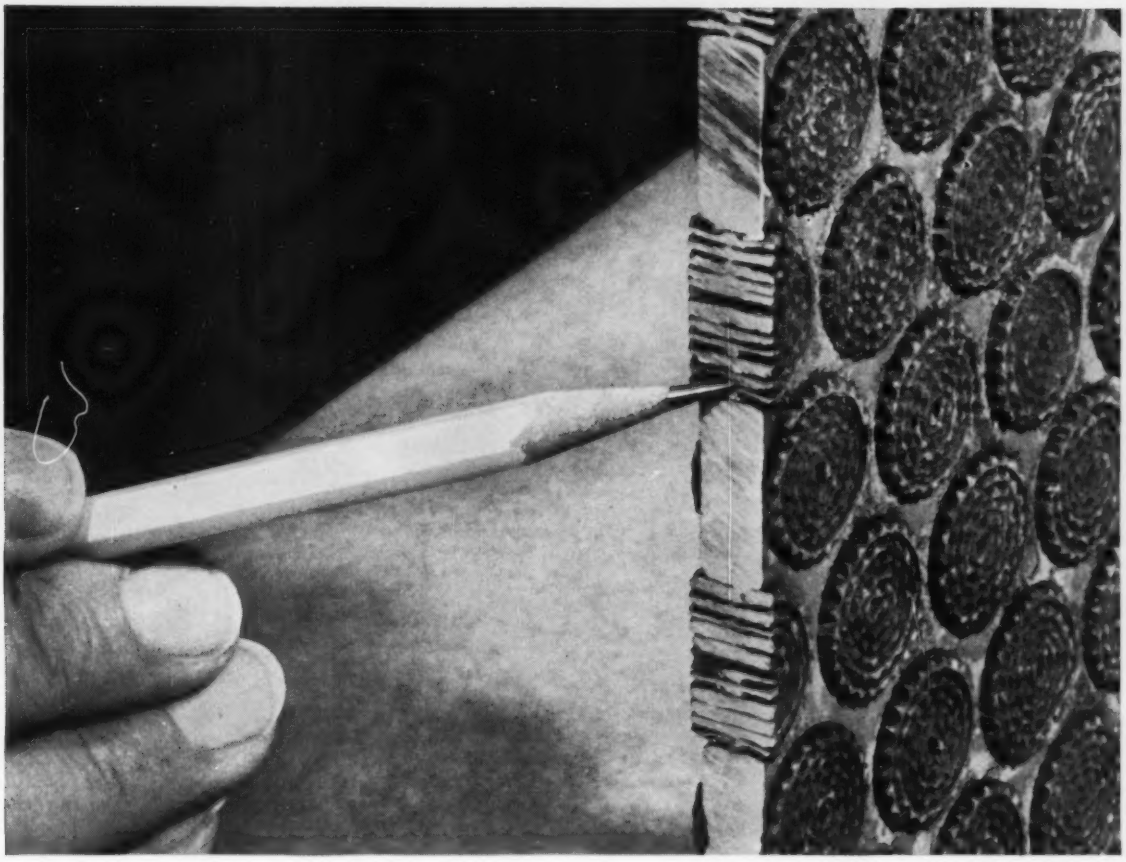

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